PROCEEDINGS

OF THE

NATIONAL SCHOOL

OF

DENTAL TECHNICS

FOR THE YEARS 1893, CHICAGO. 1894, OLD POINT COMFORT. 1895, ASBURY PARK. 1896, SARATOGA.

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CONTENTS.

OFFICERS

OF THE

NATIONAL SCHOOL OF DENTAL TECHNICS.

1893–1894–1895–1896.

Organized at the World's Columbian Dental Congress, Chicago, 1893.

1893.

President, D. M. Cattell. Secretary, J. A. Dale.

Committee on Constitution and By-Laws,

T. E. Weeks, H. P. Carlton, J. A. Dale.

1894.

President, D. M. Cattell. Vice-President, T. E. Weeks.

Secretary and Treasurer, J. F. Stephan.

Executive Board,

T. E. Weeks, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1895.

President, T. E. Weeks. Vice-President, S. H. Guilford.

Secretary and Treasurer, J. F. Stephan.

Executive Board,

D. M. Cattell, 3 years; N. S. Hoff, 2 years; H. W. Morgan, 1 year.

1896.

President, H. W. Morgan. Vice-President, S. H. Guilford.

Secretary and Treasury, J. F. Stephan.

Executive Board,

G. H. Wilson, 3 years; D. M. Cattell, 2 years; N. S. Hoff, 1 year.

Introductory.

The purpose of the Executive Board in the preparation of this first report is to give all of the principal data of the rise of the School of Dental Technics. With that end in view it seemed wise to incorporate the two principal contributions to our literature on this subject, which appeared prior to the organization of the school. The first is by Prof. G. V. Black and the second by Dr. D. M. Cattell. These papers show clearly the beginning of the teaching of systematic operative technique and its status at the time its teachers organized.

For the papers and reports in the remaining pages the Board has no apologies, as they deem them all valuable contributions to educational literature.

No stenographic notes of discussions were taken until the meeting of 1896, and these were lost (never returned by the reporter), so many good points which were made by various members cannot be introduced. Another feature of the meetings which has possibly been of the greatest importance as an educational factor is the exhibits of work performed by students in the several colleges of the school. This feature cannot of course be reproduced and any description would fall short of conveying an adequate idea of the work.

Dr. Wilson's report will repay careful study to all who are interested in this work, and when compared with the supplemental report which will be offered at the next meeting and incorporated in the next annual proceedings, will show how the teaching of technics is being enlarged and improved.

The Board has encountered many difficulties and met many disappointments, but we feel sure the readers of this report who represent the colleges of the school will throw the mantle of charity over its apparent incompleteness.

With this explanatory word we offer this first report of the work of the National School of Dental Technics.

Thos. E. Weeks,
N. S. Hoff,
Editors for the Executive Board.

Historical.

Prior to the convening of the World's Columbian Dental Congress in 1893, the movement for *systematic* teaching of Dental Technics started by Prof. Black in 1888 was confined to a few colleges and a comparatively small band of workers. The original article by Prof. Black published here (taken from *Dental Review* July, 1888), and an editorial by Dr. E. C. Kirk, being about all the contributions to our literature up to that time.

A course in dental anatomy and operative technic was inaugurated in the Chicago College of Dental Surgery in 1888–9. The next school to take it up was the College of Dentistry of the University of Minnesota, 1889–90. Dr. D. M. Cattell was the teacher in Chicago and Dr. T. E. Weeks in Minnesota. Courses in Prosthetic Technic followed immediately in both colleges. The courses in both these schools were practically as outlined by Prof. Black.

The incentive for the organization of the National School of Dental Technic came from the two following papers; one by Dr. G. V. Black read before the Chicago Odontological Society, June 21st, 1888, and the other read at the World's Columbian Dental Congress in Chicago, August 18th, 1893.

Outlines of a Course of Study in Operative Dental Technics.*

BY G. V. BLACK, M. D., D. D. S., CHICAGO, ILL.

Under the term technics, if used in the broadest sense, would be included all of the handicraft by which things are fashioned, and therefore all pertaining to the use of instruments in operative dentistry. But it is now proposed to found a department of study preparatory to this, which shall include all dental operations, as nearly as may be, which shall be done out of the mouth. This is for the purpose of training the hand and eye for performing operations within the mouth. It is to this that I now wish to limit the term Operative Technics.

It is to be understood in the beginning that this department of study is not to limit or in anywise to take the place of either the practical operations in the infirmary, or the teaching now being done in the college lecture-room, but that it is to be additional thereto.

In this department it is proposed that students shall be taught the nature and physical qualities of the teeth upon which they are to operate, of the materials they are to use, and of the instruments by means of which they are to use them. This I would do in a series of object lessons, by having students handle teeth and study their forms and examine enamel and dentine by cutting them with instruments; manipulate the material used for fillings, study and practice the use of instruments, and learn the tests for perfect manipulation.

ANATOMY OF THE TEETH.

The first step in the study is the anatomy of the teeth, and the consistence or physical qualities of enamel and dentine. This I would do by having students handle and examine minutely the forms of the several human teeth, by having them cut them with the instruments they are to use in practice, and by examining their minute structure with the microscope. The general study of the histology of the teeth may be had in the histological laboratory as heretofore; but the study of the minute forms of the enamel with reference to its cleavage, and the bearing of this on the forms that

*Taken from the *Dental Review*, July, 1888.

should be given to the margins of cavities for filling, should belong especially to this course of study.

In the study of the forms of the teeth the instruction in this department should follow the didactic teaching of the anatomy of these organs by giving the students teeth from various positions in the mouth, and require them to determine by their form from what part of the mouth they came, whether permanent or temporary, etc., and give the peculiarities of form by which this is determined for each tooth. The cusps and sulci of the teeth should be named and described. Each tooth should also be described as to the peculiarities of the shape of its several surfaces and form of its root or roots. Furthermore, each should be properly classified, as, long cusped, short cusped, bell crowned; or the reverse, as, thick necked, laterally compressed, well formed, indifferently formed, malformed, long rooted, short rooted, abraded, faceted by opposing teeth, etc. Indeed, every characteristic pertaining to the class of teeth to which it may belong, be it molar, bicuspid or what not, and the characteristics of the individual tooth, should be brought out. This will require much of invention on the part of the instructor, for the reason that we have no adequate description of the human teeth in our literature, and the rules of description and study must be made new. But it is only in this way that we may impart a knowledge of the forms of the teeth to students. This whole matter needs to be reduced to rule. This exercise might not require the whole of very many of the first lessons, perhaps; but it should be continued throughout the whole course, by requiring that every tooth that comes before the class for any purpose be accurately described before anything else is done with it.

THE PULP CHAMBER.

The next step should be the study of the forms of the pulp chamber and root canals. This must, of course, be done by cutting the teeth in such a way as to expose these cavities to view. Some of the first lessons may be taken by simply breaking the teeth open, until students have learned something of the part of the tooth in which these cavities are located; but very soon the cutting should be done by fairly well fixed rules, and the idea should be made prominent that this is for the purpose of enabling the student to gain such a knowledge of the subject that he may cut into the crown of a tooth under any condition of partial obscurity in the mouth and, strike accurately such part of the pulp chamber as he may desire, and understand the relations of that cavity to the cut he has made.

Incisors and cuspids, upper and lower, should be cut in three directions, as follows:

1. Lengthwise—labio-palatal or lingual.
2. Lengthwise—mesio-distal.
3. Crosswise in nearly all parts of the length of crown and root.

These should be ground perfectly flat on special emery wheels provided for the purpose, and, when ground, the student should be required to make silhouette prints from them and present a copy to his instructor as a record of his work. This printing should include the various cuts from each tooth of the entire human denture (of one side), and, if possible, all of these should be made by each student.

The bicuspids and molars should first be ground across, beginning on the cusps or grinding surfaces and continuing until the horns of the pulp are discovered. Here the difference in the location of these with reference to the grinding surface will at once become apparent to the student in the long and short cusped teeth, bell-crowned and thick-necked teeth, etc., and he will be made acquainted with the importance of distinguishing these factors by the outward shapes of the crowns of teeth; a good practice will be to saw the tooth through the crown. A print should be made when the horns of the pulp are first seen, and then the grinding should be continued until the bifurcation of the roots—in the doubled and tripled rooted teeth—prevent further progress, meantime making frequent prints. This will include the whole form of the pulp chamber and the branching of the canals. The tooth may now be turned and the grinding begin at the points of the roots, thus completing the work. In many cases it will be well to proceed from the apices of the roots at first and do all of the grinding from this direction.

During the grinding, beginning at the crown, the student should, when the pulp chamber is fully opened, be required to pass broaches through all of the roots, and be questioned, as a matter of study, as to the position the handle of the broach would hold to the face if the tooth were in the mouth, and as to what part or parts of the crown would have to be removed to give proper access to the canals.

There are a great many points that should be brought up by the instructor in connection with this grinding, such as the thickness of the walls of dentine at the various points where caries occurs;

the peculiar directions in which root canals diverge from the pulp chamber in teeth of different shapes, etc.

After this cross-grinding, as much lengthwise cutting should be done as practicable. Some of this should be from lingual to buccal, and some from mesial to distal. This latter is especially valuable in bicuspids and lower molars for illustrating the thickness of the walls of the dentine and the location of and danger of exposing the horns of the pulp in proximate cavities.

In this course, if students examine the work of their classmates, comparing teeth and pulp chambers one with another, each will obtain a good general knowledge of the forms of pulp chambers and root canals; indeed, such a knowledge as few dentists of to-day possess.

EXCAVATING.

Excavating carious cavities in teeth out of the mouth should be a prominent feature of the course. The obtaining of teeth for this may be a matter of much difficulty in large classes, for the reason that it should be done in teeth freshly extracted, though much of valuable illustration may be had upon dried teeth that have been soaked in water—water to which some antiseptic has been added.

Perhaps a few of us would wish to use specific rules in excavating. It is likely, however, that most of us come to do so without knowing it. Some years ago when I began to study this matter with the view of formulating rules of procedure, I was surprised to find how closely I was following fairly fixed methods. But for the purpose of teaching we must adopt rules, otherwise our teaching will fail to impress the student from the want of fixedness and form. Furthermore, when I speak of rules for excavating, I do not have reference to the shaping of cavities for the retention of fillings. This the student will find in the books already. I refer to the motion and direction of the motion, of the instrument and the kind of instrument for opening cavities, removing carious dentine, and finally we may take up the forming of cavities. What parts of cavities should first be cut, and how, by what instruments, and the order of procedure that will give the best results should be systematically taught. Since I have been watching the work of students in the infirmary, the necessity for this kind of teaching has become strikingly apparent. When a patient comes with an aching tooth, the first thing a student does usually is to thrust an excavator into the pulp. Day after day I have tried to show them how to do this excavating without wounding the pulp, but in the mouth the motion of the instrument and the direction of the cuts are difficult to see,

and too often the omnious scream is heard with the very next patient. I am satisfied that a much clearer idea of this can be given upon teeth out of the mouth. It is difficult to show the cleavage of the enamel well in the mouth so that students may grasp the idea and be able to use this knowledge to advantage, in applying force in the right direction for the opening of cavities. It is still more difficult to show clearly how, by certain sweeps of properly selected excavators. the entire margins of cavaties can be quickly cleared of carious dentine, leaving that part over the pulp to be carefully removed when one can see just where his instrument is going. Indeed, until one can excavate closely about an exposed pulp without touching it, in a cavity filled with blood, merely having the outward form of the tooth in his eye, he is hardly fit to practice. I do not recommend such a procedure as a routine practice, however.

THE ENAMEL PRISMS AND CLEAVAGE.

Study of the enamel prisms with the view of determining their direction on the several parts of the crowns of the teeth should be made. This, when learned, becomes an index to the cleavage of the enamel, being always in the long axis of the prisms. An intimate knowledge of this is important in the opening of cavities, as it shows at once the direction in which force should be applied in chipping away overhanging margins. Its greatest value, however, is in the shaping of margins of cavities preparatory to filling. In order that the margins of cavities may have the greatest strength, the enamel should be cut very nearly in the length of its prisms, or in the direction of cleavage, otherwise they will not well bear the condensation of gold against them, nor will they endure after the gold has been placed. Especially is this true if the inner ends of the prisms have been cut away, leaving the outer unsupported. While some vague expression of these facts exists in our literature, I know of no sufficient studies of the subject having been published.

Dr. Jack in his admirable article in the American History of Dentistry, disposes of this whole subject in a paragraph. In Harris' Principles and Practice of Dentistry (1885) it is not mentioned. Failing of fillings, apparently from want of appreciation of this subject, is often seen in otherwise splendid operations.

I know of no way of properly fixing this matter upon the minds of students so as to make it available for correct use in practice except by a critical and somewhat extended study of the direction of the enamel prisms, and of cleavage on the different parts of

the crowns of the several teeth. This must be done by grinding sections in various directions across and lengthwise the crowns of the several teeth, developing the prisms by the use of dilute acids so that they are plainly seen with low powers of the microscope, and studying them in detail. This is readily done with powers so low that a considerable part of the circumference of a crown may be seen at one view, and the direction of its prisms noted, and drawn by students who have no extended knowledged of microscopy and the forms of margins of cavities planned. These studies should be made in sufficient number and accompanied by sufficient questioning, to enable the student to determine the direction of the enamel prisms anywhere on the crown of any tooth by observing its form.

Another aid in this study, which is very important, will be found in illustrations of cleavage of the enamel, by careful chipping with chisels or any sharp instrument. For this exercise we need the enamel of parts of the crowns of the teeth from which the dentine has been removed. Many good specimens for this purpose will be found in extensively decayed teeth with large portions of undermined enamel; but they may also be prepared by burring out the dentine with the engine. This latter ought to be done in a sufficient number of cases to well illustrate the normal strength of the unsupported enamel, for otherwise the student is liable to suppose that the easy chipping is due to the weakening of the enamel by caries, which is only partially true. In either of these preparations a little practice enables the student to chip away the enamel, so as to illustrate its cleavage and confirm his microscopic studies, on all available portions of the crowns of the teeth.

This course of study will, if well followed, show students why the enamel at the margins of cavities should be cut in certain definite shapes in order that they may resist crumbling, in the insertion of fillings, and endure after fillings have been placed, and thus prevent, in a large degree, the errors so constantly seen in practice.

OPENING OF PULP CHAMBERS.

I should also introduce some distinct method of instruction in the opening of pulp chambers and filling root canals. One point of the first importance in this study is that the student should learn how and in what direction to pierce a sound tooth or one with a filling, so that his drill will enter a particular portion of the pulp chamber and give the most direct access to the root canals. He should be carefully taught the particular direction his drill should

take in each individual tooth of the set of thirty-two. For this purpose, and for the studies which follow, there is probably no better method than to have the students take impressions of each other's teeth (wax or modeling compound will answer and be more cleanly than plaster), and then place one, two or a half dozen natural teeth in the impression of those with which they correspond and include them in a plaster cast. If this be done skillfully, the result will be a plaster cast with certain natural teeth in position, upon which operations of any sort may be made and, if thought best, they may be so inclosed that the approach will be about the same as in the natural mouth. This may be done by mounting casts of the upper and lower jaw on a hinged articulator, that will open only as much as the mouth.

Upon these teeth students may practice drilling for pulp chambers, studying the direction the drill should take in the various teeth. Also the opening of pulp chambers through carious cavities in grinding and proximate (distal and mesial) surfaces. They may also practice the cleaning and filling of root canals, in which they may make use of the various methods, and determine how nearly perfect their work has been by after examination.

FILLING TEETH OUT OF THE MOUTH.

Filling teeth out of the mouth and afterward testing for leakage, should form a part of this course. This should be done with the view of teaching useful rules for the manipulation of the several materials used, and familiarizing the students with their essential qualities. In this work the manipulation of the materials used for temporary fillings should receive due attention; particularly gutta-percha and the oxyphosphate of zinc. These two, while the best in use, require special handling in order to obtain good results. Gutta-percha, especially, should be closely studied until the student becomes able to make fillings that will bear the ink test. These may be made in glass tubes. The use of a number of boxes of oxyphosphate of zinc, in teaching students the proper methods of handling it, would be a matter of economy for the colleges.

It will be especially useful to introduce a variety of amalgams, the composition of which is accurately known, and study their peculiarities as regards manipulation and their liability to shrinkage and spheroiding, as shown by the ink test. This may be varied by mixing with more or less mercury. This may also be conveniently done in glass tubes, but teeth should also be used, and in these, practice in contouring can be had, which will constitute a very useful exer-

cise. In this work students will learn much of the conditions of success and failure, mechanically considered, of operations in the mouth, and if happily they succeed in establishing in their minds the idea that the essential points in a filling are the perfect exclusion of moisture and a perfect border or margin, much good will have been done.

Tin may be used to demonstrate the manipulation of tin itself, and largely for that of soft gold. I am satisfied that few students of to-day are learning the value of tin as a filling material. The too nearly universal habit of using cohesive or semi-cohesive gold has banished from the dental depots all instruments suitable for the manipulation of either tin or non-cohesive gold foil, and practically neither are in use except for filling the cervical borders of large proximate cavities. We cannot use tin very successfully without resorting to the old plan of wedging, and without this, non-cohesive gold cannot be used successfully for entire fillings. I, for one, would like to see this ancient and now almost lost art revived. I believe that students would more readily learn to make fillings by that plan which would bear the ink test than with cohesive gold.

Gold filling, with both the soft and cohesive forms, should be done as far as expense will allow, followed by very careful ink tests for leakage. I should favor making these tests in teeth, rather than in glass tubes. Any considerable leak will show through the enamel within a few days if the tooth, when removed from the ink, be properly washed. Enamel will not be stained by ordinary ink. For still more delicate tests the aniline dyes, dissolved in alcohol, may be used. These will penetrate where the ordinary inks will not go.

In this work very careful instruction should be given in the essential rules for packing cohesive gold, for without this the expected instruction would be too liable to end in useless experimentation.

In connection with the filling with gold, careful studies of the physical and chemical qualities of gold foil should be made. At least, the conditions of the loss of the welding property of foil and the use of ammonia should be given sufficient experimental study to enable students to become intelligent in regard to it. Certainly the student should be sufficiently instructed so that he can readily appreciate the difference between the true cohesive condition of gold foil and the non-cohesive or semi-cohesive conditions, and be able to use each intelligently. In order that he may

do this, I believe it is essential that he pick apart, or endeavor to pick apart, fillings that he has made in order that he may learn how much cohesion has been obtained. This point cannot be well taught in the infirmary practice.

PLAN OF CARRYING OUT THIS COURSE OF INSTRUCTION.

The room for this work should be provided with benches very similar to those usually found in the mechanical laboratories of our colleges. The pupils should be divided into classes of suitable numbers, to be managed by one instructor, enabling him to give special attention to each individual as required. Much of the time should be mixed with short demonstrative lectures, as this or that essential point may come up. For the most part, each member of the class should be doing the same thing at the same time, so that these lectures may be directed to the class rather than to the individual. In some cases it will be found good management to detail sections of the class for certain hours to do certain work, as that of grinding certain teeth, etc., rotating these sections so that in the end all perform the same duties. The class should devote about three hours every day to the work during the time they may be employed in this way. And when one class is finished another may take its place, until all the pupils of the school are accommodated. This plan has given excellent results in the department of Prothetic Technics in the Chicago College of Dental Surgery during the last year, and I have every reason to believe that it will do the same in operative technics.

POSITION OF THIS COURSE OF STUDY IN THE CURRICULUM.

Perhaps some importance should be attached to the time in the course of the student's college work at which this study should be introduced. There are many reasons for introducing it during the first year. It seems hardly fair treatment to infirmary patients to subject them to the awkwardness of students who have had no drill in the preparation of cavities nor in filling. But in most of our schools the junior year is overcrowded already, so much so that students have hardly sufficient time for the necessary study on the subjects already allotted to them. Again, it seems to me that this course will benefit the student most if given in conjunction with his infirmary practice, and after he has learned something of the difficulties he will have to encounter. Still there is a very serious objection to this in the fact that if it is placed in the senior year many of the students will be unable to get into the classes until

toward the latter part of the term, which would certainly not be well. It will probably be better in most schools to shift some other branches to the senior year, if necessary, to make room for the operative technics in the first.

Operative Technics.*

BY D. M. CATTELL, D.D.S., CHICAGO, ILL.,
Professor of Operative Technics in the Dental School of the Northwestern University.

The name, "Operative Technics" is understood as the title of a department recently added to the curriculum of a few dental schools.

Since students began matriculating in dental schools as their first step in the study of our profession, rather than placing themselves under the guidance and direction of competent practitioners, where they acquire a certain amount of manual training before entering college, it has been noticed with regret that students in the clinical departments were not so well trained in the use of instruments at the beginning of their career at the chair as was desired; nor were those so apt who came first to college as those who had taken advantage of preliminary work under a preceptor.

So marked was this lack of manual dexterity that when Dr. G. V. Black took charge of the infirmary of the Chicago College of Dental Surgery he immediately set about to devise some means by which this deficiency might be overcome. His cogitations resulted in a lengthy paper before the Odontological Society of Chicago, June 21st, 1888, entitled, "Outline of a Course of Study in Operative Dental Technics." The culmination of this cogitation, paper and discussion following was the inauguration of the *Operative Technic* course of study in the Chicago College of Dental Surgery, at the opening of its next school term, September 26th, 1888.

When the first class of 36 students was organized, it became known as the *World's Pioneer Class in Operative Technics*. The particular field of labor designated, (the ground having never been "broken"), was somewhat uneven—here and there good, rich soil was found, with now and then a rough and stony spot to till.

But considering the newness of the course established, the inexperience of the instructor in that kind of work, the lack of practical experience as a guide to better effort, with no text book

* From the Transactions of the World's Columbian Dental Congress, Vol. II., p. 631.

applicable to any one of the many lessons gone over, the "Pioneer Class" is one long to be remembered in the annals of that school's history. Many members of the class since graduating have taken responsible positions; and one of its members is the present instructor in the Operative Technic department of the same school.

The second year's work, with the path somewhat beaten by the previous year's treading, was much easier to travel; although many places low in the path of progressive instruction had to be built up; at other points, knolls too high had to be graded down.

The third year was marked as one of decided progress owing to the fact that Prof. G. V. Black had issued, during the latter part of the previous year, a book entitled "Anatomy of the Human Teeth." This was just such a work as we had needed from the start and it was gladly adopted as our text-book in the study of human teeth.

Five years have now passed since the inauguration of the first class in dental operative technics. In that time much improvement has been made in methods of teaching; much care has been given to systematizing the work so students can readily grasp ideas.

In its beginning, the course occupied three months' time; by adding new and important lessons, and by more careful work in old ones, the course is now lengthened to six months.

Two years ago, when the Northwestern University Dental School was reorganized, an Operative Technic department was established as one of its freshman studies. Such a course has been established in the Dental Department of the Minnesota University, and has been a success for two or three years. It is understood that the American College of Dental Surgery, the Department of Dentistry, Vanderbilt University, and the Ohio College of Dental Surgery, are contemplating establishing such a course in their curriculum the coming year.

There are a few other schools that have talked vaguely about the establishment of such a course, but as to the number of colleges or the thoroughness of the work the writer has no knowledge.

The Technic department has for its aim four cardinal points:

1st. *Manual training,* or handicraft.

2d. *System.*—Each step following the other in methodical order.

3d. *A greater familiarity with teeth.*—Outward forms, inner channels, structure and plan of development.

4th. *Individual reasoning.*—Teaching students how to think for themselves, to believe nothing just because "Pap said so."

The work of the department is divided into studies or lessons. Each division has its own heading, and notes of all work done under that heading must have its particular allotment of space in the note-book of each student. One study may be extended over a period of from three days to as many weeks, owing to the breadth and importance of the subject; or certain lessons may be continued and taken up again as opportunity presents. The present course, as given in the Northwestern University Dental School, is divided as follows:

1st. *A Study of Technical Terms*, a hundred or more words that the student will come in contact with all through the lecture courses and text-book reading. These words, when thoroughly understood, become the key by which students can often unlock and open to themselves the meaning of many otherwise obscure sentences. Examples: Abscess, ulcer, pulpitis, pericementitis, disinfectant, antiseptic, incise or incisor (scissors), septic, aseptic, caries, necrosis, mortification, gangrene, stimulant, anodyne, anæsthetic, deciduous, mesial, distal, buccal, occlusal, etc., etc.

2d. *A Study of Typical Tooth Forms*, including their several surfaces and surface markings; noting certain "landmarks" peculiar to each denomination of teeth, also malformations. In this lesson each student has the work of Professor Black on the teeth as a text-book. He is also supplied with a "ring of teeth"—a set of typical teeth properly arranged and strung on wire bent in the form of a ring for convenience in handling. When the study of a certain tooth is taken up, the student has this tooth before him on the ring. There are also charts hung up in the class room. These charts represent the same pictures enlarged as seen in the text-book, showing the several surfaces of each respective tooth. If possible, the student should have several teeth before him of the same denomination under discussion, that he may become familiar with the common variety of forms. After going carefully over the several surfaces and noting their lobes, developmental lines, sulci and other surface markings, each student is then invited to select a tooth similar to the one undergoing inspection, from a miscellaneous lot of extracted teeth.

3d. *A Study of Pulp Chambers and Canals.*—The student, having been supplied with a box containing some twenty or more wooden blocks one and one-fourth inches long and three-fourths inches thick, now fastens the tooth he has just selected lengthwise on the block with sealing wax. The tooth and block can now be set in a small bench vice. Two or more teeth of the same denomination are to

be selected and so arranged upon the blocks that different faces of the tooth will be presented to view. With selected files the student cuts away the tooth fastened on the block, so as to expose the pulp chamber and canal throughout its entire length. The cutting continues until the central portion of the chamber is reached, when he removes the block and tooth from the vice. Now, using the block as a handle, he inks the exposed cut surface of the tooth upon an ink pad, and then stamps or prints an outline of the tooth upon a slip of selected paper, and the result is the socalled "silhouette pictures" showing the pulp chambers and canals. Of each tooth so dissected, the student makes a line containing not less than five pictures. And of each denomination of teeth there should be several aspects of the chamber opened. When all the cuttings are made, the blocks to which they are attached are arranged in proper order in the original box and kept by the student as a memorial of his early professional studies. The silhouette pictures of each denomination are printed on separate pages of a specially ruled blank book, and constitute when done a text-book, if you please, on the subject, that the student may keep for ready reference.

4th. *The Physical, Anatomical, Chemical and Microscopical Divisions of Tooth Structure.*—These studies are prepared by means of lectures and charts, and when possible, students prepare both longitudinal and cross sections, studying them through the microscope. This work for the freshmen should be rudimentary, as a more careful study of both hard and soft tissues will be had in the regular histological course. A special study of enamel in reference to cavity margins is made. The idea is to impress upon the student's mind the need of greater care in preparing enamel margins of cavities preparatory to filling.

5th. *Free Hand Drawing and Modeling.*—The drawing of the different surfaces of the teeth by students, helps to train the hand as well as calling closer attention to form and certain surface markings. While the time is not sufficient for a thorough course in drawing, yet much may be done in the way of starting the students toward a better method of explaining or demonstrating a point before future dental societies. Modelling teeth in clay or its equivalent is excellent training for both hand and eye, and should be indulged in as much as time will permit. The models should average at least six inches in length.

6th. *A Study of the More Common Medicaments,* such as are found generally in dental offices. This is not intended to supplant the systematic work of the chair in materia medica and therapeutics,

but is preliminary to it; not going into detail other than to give t origin of the drug and the name of the dentist who proposed t remedy, if known, and his method of using it; also from when the medicine is derived—many of these remedies are compounds mixtures. These remedies should be classified as disinfectants, ant septics, anodynes or obtunders, stimulants, counter-irritants, et Each student should have in his case some eight or ten bottles, ar these should be supplied with certain medicines for his experimen while in the class. These drugs are to be handled, looked a smelled, tasted—indeed gotten thoroughly acquainted with.

7th. *Students Select from a Miscellaneous Lot of Teeth Place Before Them, a Set*, many of which should contain cavities rangin from simple exposure of dentine to large cavities involving pul chambers. These teeth should be properly arranged as to origin position, and their roots imbedded in gutta-percha. This set of teet so arranged is to be considered a *dummy patient*, for the student t practice upon. A wooden block carved to the shape of a huma head, with a moveable lower jaw, and instead of ridges to represer the alveolar processes, there should be wide and deep grooves int which the gutta-percha that is to surround the roots of the teeth i placed. (Magnusson's dummy head is excellent.)

8th. *Pulp Capping and Devitalization.*—With the "dummy before him, representing a supposed patient, the student seeks fo slight pulp exposures; having just listened to a lecture on the sub ject by the chair, regarding the diagnosis, prognosis, treatment an final capping or devitalization. As each pathological case is pre sented, the student applies the remedies supplied in his case-bottle as directed by the instructor; after due treatment the suppose exposed pulp is capped or devitalized according to the specific direc tions of the instructor in charge.

9th. *Supposed Cases of Dying Pulps, Putressent Pulps anc Entirely Decomposed Pulps.*—From the medicines furnished him each student applies treatments to the different conditions suggested until he becomes familiar with the class of remedies required in each pathological condition.

10th. *A Student of the Pathology and Therapeutics of Alveolar Abscesses,*—blind or sleeping, acute, chronic, fistulous. Also of ulcers, pulpitis, pericementitis, etc. This is done by lectures and charts; students making applications to supposed lesions from their medicaments.

11th. *Cleansing, Drying and Filling Root Canals* is practiced until students become quite familiar with the different methods of

procedure, giving preference always to the one considered the best.

12th. *Bleaching Teeth.*—This study is made by the way of lectures and experiments in test tubes or beakers upon vegetable matter so that the results are soon observed by the students; and also by practical application to discolored teeth found in the miscellaneous lot.

13th. *Instruments.*—Each student supplies himself with a set of instruments and certain appliances according to a list furnished him. No other patterns are allowed. These instruments are a part of the set required of junior and senior students on entering the infirmary the following year. These instruments are classified and named. This classification and naming are according to certain rules recently proposed for the use of the school by Prof. G. V. Black. Students are furnished brass wire of a certain size from which they are to make models of those called for by the list.

14th. *Preparing Cavities.*—Students are instructed regarding the opening up of cavities and the proper shape they should assume. The simpler forms only are studied here,—beveling of enamel margins; what instruments should be used and how to grasp them. (No engine is allowed in this course.) *Hand training* is one of the cardinal points. Ivory, bone or certain compounds are often substituted for teeth, in which to form cavities,—typical shapes.

15th. *Filling Materials.*—Students practice filling these cavities with the different classes of filling materials,—gutta-percha and the different preparations of the same; cements—both phosphates and chlorides; amalgams—alloys and copper, tin, aluminum; gold—both noncohesive and cohesive, and combinations of two or more. These filling materials are *studied.* Many of the cements and amalgams are made before the class.

16th. *Miscellaneous Matters.*—Any matter that may seem important that the Freshman Class should be posted in. These matters can be sandwiched in any time along through the course that the instructor deems best.

This course of technics may be somewhat modified each year, always with a view of bettering it. One essential condition of the course is, that nothing must be taught here that is not in accordance with the teachings of other special Chairs; nothing taught that must be untaught by succeeding instructors; hence the technic teacher should be familiar with the methods advocated by the other professors of the institution with which he is connected.

Now, if by means of this course of instruction, students can be benefitted in a manner manually and mentally, unattained by

other known methods or systems of teaching, this effort will no have been in vain.

If the student has gained in handicraft, systematized his daily course of procedure, become more intimately acquainted with the organs on which his future labors will be bestowed, has learned the art of thinking for himself, he is then ready to pass into the clinical department, and there add practical knowledge to the hints he has thus far received.

The value of this course as a part of the curriculum for Dental Schools is so aptly put by two well known educators that I will quote their thoughts upon the subject:

Prof. C. N. Johnson, Professor of Operative Dentistry in the Chicago College of Dental Surgery, says:

"My experience as a teacher of Operative Dentistry has impressed upon me one thing—that no advance has been made in college teaching equal to the establishment of the course in Operative Technics. Before this system was taught, the student who approached a patient for the first time did so with a feeling of uncertainty. It was an experiment with him. He did not know whether or not his fingers would do what he had seen other fingers do. And more often he blundered than succeeded in the beginning. In fact it was expected that he should make many mistakes before he made any successes.

"With a rigid course of Operative Technics it is otherwise. The student makes his first halting steps at the work bench, and a mistake is not so serious and does not unman him as it would if he were working on a patient. By the time the course is completed he is in a position to take a patient without doing the individual an injustice. He has learned manipulation. He knows where to expect pulp exposures. He is informed as to the number of pulp canals in certain teeth, and where the openings ought to be. In short, *he has built the foundation*, and I verily believe he has built it in the proper way. I know of no other system so effective and practical for the beginner. I do not believe its importance is fully realized by the profession."

Dr. Geo. H. Cushing, Professor of Operative Dentistry in the Northwestern University Dental School, says:

"The results of my observations as a practical teacher in the operative department, as to the value of the teaching of Operative Technics to the junior dental students, are that the difference between those who have not had this training and those who have, is very marked. The latter take hold of the practical work in the

mouth with considerable comprehension of that which is to be done, and with some degree of confidence, and their progress is so much more rapid than that of the students who have not had such training that the most superficial observer cannot fail to notice it.

"The students who have not been through the Technical course commence their practical work in the mouth with a lack of confidence, with hesitancy and uncertainty, and require for a long time the personal instruction of the demonstrator in every step of their operations, before they reach the point at which the technically instructed commence their practical work.

"I regard the thorough training in Operative Technics as the greatest advance in the teaching of practical dentistry that has been made in the last quarter of a century."

DISCUSSION.

Dr. H. P. Carlton, of San Francisco, Cal.:—I have listened with a great deal of pleasure to Dr. Cattell's paper, and especially am I pleased to add that a course is being pursued, similar to the one outlined by him, in the College of Dentistry in the University of California. The course Dr. Cattell outlines is only for freshmen, and is intended to supply the lack of preliminary practice. It is intended to thoroughly familiarize the students with working on the tissues that they will have later in the infirmary. It also familiarizes students with ideal tooth forms and pulp chambers and their treatment. We use a somewhat different dummy; it is a little model of brass, very similar to a model of the lower jaw, such as you would make in plaster, having a groove running from heel to heel, which is filled with modelling compound. The student is requested to find a full set of teeth for the lower and upper jaws, containing cavities of all descriptions, some with the pulps exposed. The model is screwed to the bench in front of each student, in the laboratory, and upon that model the work is performed. All classes of cavities are filled, and all classes of fillings are used, and this work is exhibited at the end of the term as individual work in operative technics.

Dr. Cattell spoke of the teacher of operative technics following closely the work of the other Chairs. It occurs to me that the man who instructs a class in operative technics should inculcate his ideas through, and be associated with, the Professor of Operative Dentistry, or he should inculcate his ideas through the demonstrator of the freshman class. The three years' course in our colleges does away entirely with the necessity of a young man taking any pre-

liminary work in the office. This, of course, gives the student such a thorough familiarity with the work that he will find no difficulty, when he reaches the infirmary, for practical work.

Dr. Andrew Rose, of Peterborough, Ontario:—I feel pleased at having heard Dr. Cattell's paper I am sorry that I do not see more of the practitioners of Ontario, Canada, present. We have adopted in the Royal College of Dental Surgery, in Ontario, a three years' course for our students, and I sincerely hope that in all future teaching that firm foundation will be laid during the first session. I think this is the greatest essential for success, and I think that no three terms can be successful without this careful early training.

Dr. Thomas E. Weeks, of Minneapolis, Minn.:—I wish to urge the importance of the student of dentistry at once entering a college rather than taking private instruction under a preceptor. While there are men in the profession who are teachers, the majority who are willing to accept young men as students have use for them only as laboratory assistants, and the instruction that a young man receives is not commensurate with the services that he renders. He is not started in a systematic way. It is fair to presume that the tachers in a college, who are making teaching a study, are better qualified to start young men in the right way than the practitioner who is simply practicing dentistry as a means of livelihood.

I might here ask the question, Who should teach operative technics? My friend, Dr. Carlton, of California, has said that the teacher of operative technics should be an associate of the chair of of operative dentistry. I go a step further. I say that the chair of operative dentistry should either teach or direct the teaching of operative technics. In other words, I think it is important that the man who has a clear idea of the teachings of operative procedures from first to last, should take the "primer class," that the beginner should start under the best man, and the best man is, presumably, the professor of operative dentistry. It is important that technical teaching should be carried out sequentially. It is important that when the young man enters the infirmary to practice upon patients, he should be directed by one in full sympathy with the person who gave him his first lessons. There are points that can be trusted to a subordinate, to one recently graduated, or possibly one who has not graduated at all, who has shown a special adaptability: but in the student's first operation, the teacher or professor of operative dentistry should start the man; assistants should be relegated to minor divisions all along the line.

I precede the cutting of sections by some instruction in instrument-making. I have the students make some delicate explorers of piano wire. They are easily made; if they spoil one they can easily make another. Any one who has cut sections knows it is easy to enter the pulp chamber first. Having entered the pulp chamber the broach can be inserted into the canal or canals, as the case may be; this gives the student some training in the feeling of a broach in the canal. It gives the manual training, digital training in broaching canals. The broach may be left in the canal and he may file until it is reached, which obviates the occurrence of that which I have found to be frequent with the novice — the destruction of the canal before he knew he had reached it. He strikes the steel, which warns him to be careful. There are two points that might be added to the efficiency of a silhouette print. Dr. Sudduth suggested to me that a narrow groove might be cut, which would outline the enamel. After the student has prepared the section ready for printing a silhouette, I use a very fine wheel bur, and destroy the stratum granulosum, leaving a light, fine groove. The line is all at the expense of the dentine, leaving the enamel outlined when printed. This shows, first, the position of the gingival line dividing the print into crown and root, and indicates the thickness of the enamel. This shows in the individual specimen the comparative thickness of the enamel on the different portions of the crown. These compared with similar prints of other teeth, show the relative thickness of enamel on the different teeth. It also shows the form of the dentine. In reading hastily the various text-books, we might be led to infer that the dentine gives the form of the tooth crown. Every student of section knows this is not so. The dentine is conical in every aspect, in most cases, while the exterior form of the crown may be markedly bell-shaped.

There is another point that has not been sufficiently emphasized in the past—that is, instrument-making and sharpening. Those who practice in cities, and can go to the dental depot and get the most approved instruments at a moment's notice, do not appreciate how important it is to have such knowledge. I think the student should also understand the quality of the material; so I have incorporated some lectures and instruction, by demonstration, of steel, what steel is, and the percentage of carbon that steel instruments should contain: the colors that indicate different degrees of temper, how to temper an instrument, and how to use a file in shaping an instrument. Then I give some explanation by diagram of the dif-

ferent angles for for the instruments for different purposes, for the cutting of enamel or dentine, and for scraping. It has been urged, not only in this paper, but in much of our literature, and upon the floors of our associations, that the student should be required to do his first work *only* with hand instruments. The dental engine is an important portion of our armament, and while I would not deprecate the importance of hand training, which should receive full attention and its share of recognition, yet the dental engine is used, and the moment the student leaves our hands he will use it to the exclusion of everything else. It is our duty as instructors to teach the student how to use the dental engine. I think by so doing less harm will be done than if we compelled him to use only hand instruments, allowing him to instruct himself in the use of the engine. I think the technical course is the place. You may compel him to prepare cavities with hand instruments alone, but he should have instruction in the use of the dental engine, and the proper form of burs for each kind of operation and each part of an operation, as well as instruction as to what kind of hand instrument to use and how to use it.

DR. H. A. SMITH, of Cincinnati, Ohio:—I want to bear testimony to the statement made in the paper that the teaching of technics in the manner described is a real advance in the methods of teaching, and I know the student that has taken this training comes to the chair of the patient a much more intelligent operator than without it. I might go further, and suggest that some practitioners, like myself, might be benefited by going through a course of technics. In the simple matter of root filling, about which we hear so much, the student who has mastered the cutting of teeth, as laid down and taught now in colleges, will not meet the exaggerated difficulties which we have in treating and filling root canals.

DR. DON M. GALLIE, of Chicago.—I desire to add my testimony to the advantage of this department of study as one who has been benefitted by the system of technics outlined by Dr. Cattell. I heartily recommend the systematic pursuit of the study to all students, and even practitioners, who have never practiced this method of cutting the teeth, thereby becoming more intimately acquainted with the different classes of root canals and their peculiarities. Not only is this course of benefit in regard to the treatment of root canals, but in every branch of operative dentistry.

THE CHAIRMAN.—I understand that Dr. Black is in the room, and we would like to have him come forward and speak upon this subject.

Dr. G. V. Black, of Jacksonville, Ill.—I do not know that I wish to discuss this subject, but it does me good to hear it discussed. Some years ago I worked over this subject, and talked about it, almost "against the wind," as is sometimes said. Many seemed to regard it as a wild scheme, but the work was begun, and with Dr. Cattell's help it was made a success, and its benefits seem to have been demonstrated. I think it does not require pushing now, but it still requires discussion, comparison of methods, etc., that it may be improved, and I hope it will continue to be improved. It is young yet, and its full good has certainly not yet been demonstrated. The other department, prosthetic technics, is going along with it, not in this discussion, perhaps, but it is following the same path, and is doing the same good. This good is not only to the student of the school, but it is a great good to those patients who come to the school to be treated. It is a terrible thing to turn loose a lot of boys who know nothing about the structure of the teeth, to practice upon the teeth of a lot of people, with dental engines, saws, hammers, etc., having not only not practiced, but having no practical knowledge of the anatomy of a tooth, who pass their instruments into pulp chambers where there are live pulps, etc. For the sake of humanity, these boys require this training before they go to a patient.

Dr. Otto Arbold, of Columbus, O.—I have been much interested in this subject. It is an important one, but the subject has been discussed principally from the standpoint of college teachers. I want to endorse the method that has been advocated. I am sure the profession as a whole will gladly welcome the day when such instructions are generally adopted. Our graduates of the present day are good, bad, or indifferent, depending upon the institution from which they have graduated. I have at the present time in my office a student with me, who has spent two years, of nine months each, in a dental college. He has never opened a tooth in his life, and knows very little about it. With my consent, he brought a young friend of his into the office, and I permitted him to try and fill a tooth for him. He knew nothing about the handling of instruments, about the structure or relative anatomy of the tooth, and of course he could do nothing. From that standpoint, I believe the whole profession will gladly hail the day when these instructions in operative technics are universally adopted.

Dr. Cattell, in closing the discussion, said: "My paper must only be considered as a syllabus. I said the course took now six months, and in that six months there is ample time for many

little details that could not be spoken of in the paper. I have received many suggestions from Dr. Weeks, and many others who are interested in this work, and I want to take this occasion to thank all of those who have made such suggestions, some in writing and others verbal, which have been picked up and worked in somewhere in that course, until it has become extended to six months.

The following minutes show the result of a conference of several teachers, interested in teaching Dental Technique, in Chicago, August 18th, 1893:

Art Palace, Chicago, Friday, August 18th, 1893, 4:30 p. m.

In response to the announcement made at the adjournment of Section six, the gentlemen interested in teaching operative and prosthetic technics met and listened to Dr. T. E. Weeks, who made a statement that the object of the meeting was to organize a society of teachers of Technics.

Dr. H. A. Smith was selected chairman, and Dr. J. A. Dale to act as secretary.

After short talks by most of the gentlemen present, Dr. W. H. Whitsler moved an election of officers, consisting of president and secretary.

Said action resulted in the election of D. M. Cattell for president, and J. A. Dale for secretary of the temporary meeting.

A motion then prevailed that a committee of three be appointed to draft constitution and by-laws, and report at the next meeting.

The chair appointed Drs. T. E. Weeks, H. P. Carlton and J. A. Dale.

Dr. Weeks moved that each man teaching technics prepare a synopsis of his course and mail a copy to each of the schools represented at the meeting.

A motion by Dr. Weeks was unanimously carried, that the name of the Association be called The National School of Dental Technics.

Dr. H. W. Morgan moved that the membership be limited to colleges belonging to the national association of dental faculties, and that all members of that body be invited to join the school.

Adjourned to meet at the call of the president and secretary.

J. A. Dale, Secretary.

(The call was made to meet at Old Point Comfort, Va., August, 1894, in conjunction with other national dental associations.)

The dental colleges represented at this original meeting were:

University of Minnesota, College of Dentistry.
Represented by Dr. T. E. Weeks.

Vanderbilt University, Department of Dentistry.
Represented by Dr. H. W. Morgan.
Dr. J. A. Dale.

Northwestern University, Dental School.
Represented by Dr. D. M. Cattell.
Western Reserve University, Dental Department.
Represented by Dr. W. H. Whitsler.
Dr. G. H. Wilson.
University of California, Dental Department.
Represented by Dr. H. P. Carlton.
University of Michigan, Dental Department.
Represented by Dr. J. Taft.
Ohio College of Dental Surgery.
Represented by Dr. H. A. Smith.
Louisville College of Dentistry.
Represented by Dr. Francis Peabody.
Royal College of Dental Surgery.
Represented by Dr. J. B. Willmot.
Dr. A. Rose.
Chicago College of Dental Surgery.
Represented by Dr. T W. Brophy.
Dr. L. S. Tenney.
American College of Dental Surgery.
Represented by Dr. W. E. Harper.

SECRETARY'S MINUTES OF THE SEVERAL MEETINGS

OLD POINT COMFORT, VA., HYGEIA HOTEL,
August 7th, 1894—9:20 A. M.

President D. M. Cattell in the chair.

In the absence of J. A. Dale, Secretary, J. F. Stephan was elected *pro tem*.

The minutes of the previous meeting, held in Chicago in 1893, were read and approved.

The roll of colleges represented at the original meeting was called and ten responded, as follows:

University of Minnesota, College of Dentistry, by T. E. Weeks.
Vanderbilt University, Department of Dentistry, by H. W. Morgan.
Northwestern University, Dental School, by D. M. Cattell.
Western Reserve University, Dental Department, by G. H. Wilson and J. F. Stephan.
University of California, Dental Department, by (no representative).
University of Michigan, Dental Department, by J. Taft.
Ohio College of Dental Surgery, by H. A. Smith.
Louisville College of Dentistry, by Francis Peabody.
Royal College of Dental Surgery, by W. E. Willmot.
Chicago College of Dental Surgery, by T. W. Brophy.
American College of Dental Surgery, by Henry Peach.

Dr. Weeks, chairman of Committee on Constitution and By Laws, offered the report of said committee, which was received.

By motion, the report was read and adopted, section by section.

CONSTITUTION.

ARTICLE I.

Name and Objects.

SECTION 1. This association shall be known as the "National School of Dental Technics."

SEC. 2. Its objects shall be interchange of thought and the improvement of the technic teaching in American Dental Colleges.

ARTICLE II.

Officers and Standing Committees.

SECTION 1. The officers shall be a President, Vice-President, and Secretary-Treasurer, the same to be elected by a majority ballot at the annual meeting.

SEC. 2. There shall be one standing committee, of three members, which shall be known as the Executive Board, the same to be elected by a majority ballot at the annual meeting.

SEC. 3. The Executive Board shall be elected and serve as follows: At the annual meeting for 1894 one member shall be elected to serve one year, one to serve for two years and one to serve for three years. At each annual meeting thereafter there shall be one member elected to serve for three years.

ARTICLE III.

Meetings and Quorum.

SECTION 1. The regular meetings shall be held annually during the meeting of the National Association of Dental Faculties and at the same meeting place.

SEC. 2. On the written application of four members representing four colleges the President may call special meetings to be held at such places as may be most convenient.

SEC. 3. Six active members, representing six colleges, shall constitute a quorum.

ARTICLE IV.

Members and Dues.

SECTION 1. Active members shall consist of Professors of Operative and Prosthetic Dentistry and instructors in Technics, or accredited representatives from colleges belonging to the National Association of Dental Faculties, who have been duly elected, have paid their dues and signed the Constitution.

SEC. 2. The annual dues shall be five dollars ($5.00) for each college, payable in advance. No member can take part in the meetings until his respective college has paid its dues.

ARTICLE V.

Application for Membership.

Application for membership shall be made in writing to the Secretary-Treasurer. It shall be referred to the Executive Board to be reported on at the first meeting after the receipt of the application.

The favorable report and a two-thirds vote of the active members present elects the applicant to membership.

ARTICLE VI.

Funds.

All funds shall be applied to the necessary expenses of the School, and shall be paid out by the Secretary-Treasurer as the bills have been appoved by two members of the Executive Board.

ARTICLE VII.

Alterations and Amendments.

Any amendments to the Constitution or By-Laws shall be proposed in writing at a regular annual meeting. It shall lay over until the next annual meeting and every active member be notified of such proposed amendment, when it may be adopted by an affirmative vote of two-thirds of the active members present.

ARTICLE VIII.

Roberts' Rules of Order shall be the authority governing this body.

BY-LAWS.

ARTICLE I.

Duties of Officers.

The duties of the President and Vice President shall be such as usually pertain to these offices in similar organizations.

The duties of the Secretary-Treasurer shall be such as pertain to the office of Secretary and Treasurer in similar organizations.

These officers are to render an annual report.

ARTICLE II.

Duties of Executive Board.

The Executive Board shall receive and act upon all applications for membership. It shall receive and act upon all bills presented to the School. It shall provide a programme for each regular meeting, which shall be in the nature of a report from members upon the several topics of Dental Technics. It shall attend to such other business as may properly belong to an Executive Board, and render an annual report of its transactions, which shall be published.

ARTICLE III.

Suspension.

SECTION 1. Any member whose college is in arrears for two years' dues shall be dropped from the roll.

SEC. 2. Any member whose college fails to send a representative for two regular meetings shall be suspended.

SEC. 3. Any member whose college is dropped from membership in the National Association of Faculties shall be dropped from the roll.

The election of officers under the Constitution and By-Laws, just adopted, resulted as follows.

President, D. M. Cattell; Vice President, T. E. Weeks; Secretary and Treasurer, J. F. Stephan; Executive Board, T. E. Weeks (for three years), H. W. Morgan (for two years), and G. H. Wilson (for one year).

The President then requested the representatives of the colleges belonging to the Association to step to the Secretary's table and sign Constitution and By-Laws for their respective schools, and pay the required fee.

Adjourned to meet the afternoon of the following day, at 3 o'clock.

August 8th, 3 P. M.

The minutes of previous meeting were read and approved.

The Constitution and By-Laws as adopted were read. A motion prevailed that they be printed and distributed to the members. The Secretary was ordered to see that the motion was carried out.

Drs. Cattell and Weeks then gave a Syllabus, with explanations, of the course in Operative Technics as taught by them in their respective schools, and Dr. Wilson gave an outline of Prosthetic work as taught by him.

The field of Operative and Prosthetic Technic teaching was then thrown open for discussion and many participated.

(According to Article 5th of Constitution, the applications for membership handed to the Secretary at this session cannot be reported on till next meeting, which will be in August, 1895.) The minutes of the present session were read and approved.

Adjourned to meet during the next gathering of National Associacion of Dental Faculties and at the same place.

J. F. STEPHAN,
Secretary-Treasurer.

Outline of Course--First Year--in Dental Anatomy and Operative Technics, College of Dentistry, University of Minnesota.

BY DR. THOMAS E. WEEKS.

Text Books.
- Black's Dental Anatomy.
- Week' Manual of Operative Technics.

DENTAL ANATOMY.

1. Descriptive Anatomy of the teeth.
   - Terminology and Nomenclature.
   - Notation.
   - Form.
   - Arrangement.
2. Structural Anatomy of the teeth.
   - Macroscopic — Component parts, their form, proportion and relation to the whole.
   - Microscopic — Structure of the component parts.

Study by recitation and practical exercises.

PRACTICAL EXERCISES—DESCRIPTIVE ANATOMY.

In the Drawing Books—Make outline drawings of the principal surfaces of the teeth.

Model in clay one tooth of each class.

Select a tooth of each denomination from a miscellaneous lot and arrange them upon wax for future use.

STRUCTURAL ANATOMY—MACROSCOPIC.

Longitudinal Sections.

Select and mount upon blocks, teeth of one side of each maxilla. File the teeth thus mounted until pulp chambers and canals are exposed, broaching canals with piano wire explorer as the filing progresses. (See manual of technics..)

Make prints in the printing book of every aspect of six teeth of each denomination, superior and inferior.

In longitudinal sections of $\frac{1\text{-}2\text{-}3}{1\text{-}2\text{-}3}$ only la. and m. aspects need be shown, but in $\frac{4\text{-}5\text{-}6\text{-}7\text{-}8}{4\text{-}5\text{-}6\text{-}7\text{-}8}$ b. li. m. and d. aspects should be shown.

Transverse Sections.

Cut sections of teeth on one side, upper and lower, as in figs. 9 and 10—Manual of Technics, showing form at gingival line, mid-

root, and apical third. Print on the pages ruled for the purpose, as in fig. 7—Manual of Technics. Exchange sections and print in this way six pages.

Duplicate sheets of each leaf must be furnished the teacher.

MICROSCOPIC.

Cut and mount one longitudinal and one transverse section of an incisor. Make drawing in drawing book of the several tissues as shown under the microscope.

The student needs for these exercises:

1 stick Am. Ex. sealing wax.

1 half round file, 8 inch, bastard cut, medium coarse.

1 bench vise.

1 alcohol lamp.

1 jewelers' hack saw, with 12 saw blades.

1 wax spatula.

1 excelsior ink pad.

1 rubber pad, 3 in. x 6 in. x ¼ in.

1 book for printing, open at end. Leaves ruled as in figs. 6 and 7—Manual of Technics.

1 drawing book.

Some fine canal explorers.

Some fine sand paper; 0 and 00.

1 tooth brush.

1 yard cotton cloth.

1 salt mouth bottle, with cork.

1 large ointment jar.

To insure uniformity, and to give students advantage of lowest prices, these materials are to be had at the desk.

The teacher provides the teeth for cutting, and the blocks for mounting; also paper tablets same texture, size and ruling as books; and some tablets of similar paper for experimental printing, and clay for modelling.

OPERATIVE TECHNICS.

I. Instruments. { Classification according to form and uses.
Action or use for each form.

II. Canals. { Gaining entrance to canals.
Removal of pulps.
Cleansing and preparing canals.
Filling canals.

III. Cavities. { Classification from location and causes.
Preparation on principles governing.

IV. Pulp Treatment.
- Conservative
  - Treatment and protection.
  - Capping.
- Radical.
  - Surgical devitalization.
  - Devitalization by drugs.

V. Filling Materials.
- Characteristics and composition.
- Preparation.
- Introduction into cavities.
- Finishing filling.

Study by recitation from Manual of Technics, with practical exercises.

PRACTICAL EXERCISES.

(*Manual of Technics.*)

Arrange in dummy articulator the teeth selected from miscellaneous lot.

Apply rubber dam in the several ways.

Wrap broaches.

Gain entrance to canals in one incisor, one bicuspid and two molars, removing pulp from same.

Cleanse and prepare canal for filling.

Fill the canals thus prepared.

Prepare cavities as in fig. 187, Manual of Technics, in tooth brush handle or celluloid teeth.

Prepare cavities of each division of the several classes, in teeth in the articulator.

Treat and cap two or more exposed pulps.

Fill the cavities in tooth brush handle with tin.

Fill the other cavities prepared:

Two or more with gutta percha.
" " " zinc phosphate.
" " " amalgam.
" " " gold.

All remaining cavities are given proper marginal outlines and the contour of the teeth restored with oxyphosphate or gutta percha.

Instruments for this work as per list.

Filling materials and medicaments furnished at the desk.

Recitations every session.

Written quizzes are given upon completing each division of a topic and marked.

Marks are given on the cutting of sections, silhouette printing, drawings and operations.

These markings, averaged with those of the final examination, determine the standing of the student.

The examination in dental anatomy is given when the work is completed. That in operative technics at the close of the term.

In the last half of the second semester, those students who have an average of 80 per cent. or above, in their practice work, are permitted to enter the infirmary, to put in practice, under the direction of the clinical professor, the principles which have been acquired in the technic laboratory.

No student will be permitted to begin practical work unless provided with the instruments and other necessaries required by the college.

Outlines of a Course in Prosthetic Technique.

BY GEO. H. WILSON, D.D.S.

The first three weeks are spent with impressions and models, first with wax, then modelling compound and lastly plaster. The students take impressions of each others' mouths. During this time a study is made of the effect of hard and soft mixing of plaster, hot and cold water, use of salt, sulphate of potash, alum, and the various separating fluids. At the close of this work full upper and lower models made from each of the three impression materials must be deposited with the superintendent.

We now begin the study of vulcanite. A plaster impression is taken of the platine surface only, make model, wax up smoothly, flask, pack, vulcanize and finish. This has given a general idea of the construction of a vulcanite denture, use of flasks, vulcanizer, lathe, etc. The piece is then broken and mended by process No. 1 (ironing-in process). The next is a full upper impression in plaster, make model, cut away central incisor and a bicuspid; the central incisor to represent recent extraction, and the bicuspid to represent that full absorption has taken place. Construct a plate, the central ground to the gum and the bicuspid gum restored with base material, vulcanize and finish. The bicuspid is then removed from the plate, and replaced by process No. 1. A lateral incisor is then added by process No. 2 (waxing to plate, flasking, packing and vulcanizing). Both of these pieces have their palatine surfaces finished by the liquid silex process.

We are now ready for a full upper denture. We furnish a model from which each member of the class takes an impression in

modeling compound, and makes a model for his individual use. The teeth are arranged without any attempt at articulation, but they must be arranged by the Bonwell dental circle, perfectly symmetrical and anatomically correct. Use pink rubber for facing and red rubber for body of plate, both vulcanized at the same time. The palatine surface finished with tin. The piece to be perfectly polished.

In our next operation we give especial attention to articulation of a full upper and lower denture; but as we have completed three pieces of vulcanite, we do not construct them of this base, as it would not give sufficient occupation for the mind to compensate for the time required. So we introduce simple models for metal work. Swaged aluminum, rubber attachment for the upper and cast metal (Kingley's formula) with rubber attachment for the lower.

When these are finished we continue the study of cast bases, by making the two partial lower pieces. The one cast with a wire stiffner, and finished with vulcanite attachment, the other cast direct to the teeth, this also has a wire strengthener.

We now construct a partial vulcanite upon the same model used for two partial cast bases. When it is finished, it is broken and repaired by process No. 2. Thus each student has had four repair cases, two by each method.

The last piece of vulcanite is a Chase combination with aluminum. The pink gum facing added by a second vulcanization.

As our last plastic piece, we construct a full upper celluloid, upon a metal model, labial and lingual surface finished with No. 60 tin, the labial surface stippled.

We now enter upon strictly metal work. We use brass and silver solder. Each student has already molded and cast for a full upper aluminium, a Chase combination, and a die or metal model for the celluloid. We furnish an easy drawing model of a partial case with a large number of teeth; a certain portion of this piece must be doubled; the soldering done by the mouth blowpipe. The next piece is a Cleveland vacuum cavity base, the soldering done by the same instrument.

Our next piece consists of four incisors, single gum teeth, well jointed and ground to fit base, backed and soldered, rimmed and two clasps. With this piece we introduce the mechanical blowpipe. The next is a partial lower swaged in two sections, each extending from a heel, and extending sufficiently far to double the portion back of the remaining natural teeth, soldered and two clasps. The last required piece is a swaged base with heavy undercuts. The die is made by the aid of cores.

This will be as much as the average student can accomplish in one session of six months. For the students that are more rapid in execution than their fellow students, and have some time to spare, we have several models that are difficult to mold and swage over. In this work the student depends entirely upon his own resources, as they are designed to thoroughly test his ability. As they are not required, they do not count for or against the student in his examination for the degree, as all the required pieces do.

The second year's work begins with crown and bridge technics. In this we use German silver, with silver solder, brass for filling cusps, pure copper for backings if desired.

We require five shell crowns:

1st. Bicuspid must be fitted to tooth stump.

2d. A bicuspid with filled cusps and articulated to model.

3d. Molar with filled cusps and articulated.

4th. A central incisor swaged in halves.

5th. Cuspid, flap system.

Any one of the six anterior teeth can be formed by either of these methods. We require four porcelain-faced crowns, a Richmond and a Case incisor, and the same two styles of bicuspids. We also require the following three bridges:

1st. First bicuspid dummy, lug upon cuspid, half cap for second bicuspid.

2d. Two bicuspid dummies, with half cap for cuspid and shell crown for molar.

3d. Half cap for cuspid, four incisor dummies, porcelain-faced crown for cuspid, two bicuspid dummies and shell crown for molar. These bridges must all articulate to model.

Transaction of 1895 Meeting.

ASBURY PARK, N. J., AUDITORIUM BUILDING,
August 7th, 1895—2 P. M.

The meeting was called to order with the President, D. M. Cattell, in the Chair.

The minutes of the previous meeting, held at Old Point Comfort, were read, the same having been previously approved.

The Chairman of the Executive Board reported favorably upon the applications of the following colleges:

University of Buffalo, Dental Department, W. C. Barrett.
Harvard University, Dental Department, Thos. Fillebrown.
Indiana Dental College, G. E. Hunt.
University of Iowa, Dental Department, W. O. Kulp.
Boston Dental College, J. A. Follett.
Kansas City Dental College, J. D. Patterson.
University of Tennessee, Dental Department, J. P. Gray.
Baltimore College of Dental Surgery, B. Holly Smith.
Southern Medical College, Dental Department, Frank Holland.
Western Dental College, D. J. McMillen.
Philadelphia Dental College, S. H. Guilford.
Pennsylvania Dental College, C. N. Pierce.
Birmingham Dental College, T. M. Allen.
Atlanta Dental College, Wm. Crenshaw.
Cincinnati College of Dental Surgery, W. T. McLean.
Detroit College of Medicine, Department of Dental Surgery, G. B. Shattuck.
Cleveland University of Medicine and Surgery, Dental Department, C. B. Dewey.
Columbian University, Dental Department, J. Hall Lewis.

By motion, the rules were suspended and the Secretary was instructed to cast an affirmative ballot for the 18 candidates applying for membership. The ballot was cast, and the said colleges became members on signing the constitution and by-laws and paying the usual fee.

The committee on answers received regarding operative and plate technics reported progress. They were instructed to finish the report and have the same printed in the regular proceedings of the society.

Dr. D. M. Cattell read a paper, and gave a blackboard exercise on instrumentation technics. A short and lively discussion followed.

Dr. C. M. Bailey's paper on Orthodontia and Bridge Technics was read by Dr. Weeks, in the absence of the writer.

Dr. G. H. Wilson's paper on Metal Plate Technics was read by Dr. Ambler, owing to the absence of the writer.

The discussion of these two papers was deferred until a later session.

Adjourned to meet at a time to be announced in the America Dental Association's next session.

August 8th, 1895—2:40 P. M.

The adjourned meeting was called to order by the President.

The Executive Board reported favorably upon the applicatio for membership of University of Pennsylvania, Dental Department

By motion, the rule was suspended and the Secretary instructec to cast an affirmative ballot, thereby electing the candidate to membership.

The Chairman of the Executive Committee reported a communication from the Executive Committee of the National Association of Dental Faculties, asking that we meet with them in 1896.

By motion, the proposition was received and discussed, resulting in a suggestion to the Executive Board that it might be well to meet with the Faculties' Association, as they proposed furnishing us a suitable room and dividing the time with us, so as not to have the sessions of the two societies conflict.

(The Ex-Board acted upon the suggestion and accepted the invitation.)

The meet was then thrown open for the discussion of the papers read at the previous session, as moved.

At the close of the discussion, the Association proceeded to the election of officers for the ensuing year.

The balloting resulted in the selection as follows: President, Dr. T. E. Weeks; Vice-President, Dr. S. H. Guilford; Secretary and Treasurer, Dr. J. F. Stephan. Executive Board, Dr. D. M. Cattell (three years), and Dr. N. S. Hoff (two years, in lieu of Dr. Weeks, resigned, having been elected President). (Dr. H. W. Morgan remaining one year.)

Minutes of the previous and present sessions were read and appoved.

Adjourned to meet at Saratoga in August, 1896.

J. F. Stephan,
Secretary and Treasurer.

"A Talk on Instrumentation Technics."

BY DR. D. M. CATTELL, D. D. S.
North Western University. Dental School.

For many years a great need in infirmary work has been a systematized nomenclature and classification of instruments, so that an instructor can call for a certain instrument and the student readily understand the call.

Since the Technic course has been established, the need of such systemization has become more pronounced.

When cavity preparation is on for the day's class work, the teacher may wish the pupil to pick up and hold, according to instruction, a certain instrument as an excavator. By what rule can a particular excavator be called that will distinguish it from its fellows, that so nearly resemble it, yet differ in some detail that is important to the operator at the moment?

I have here a set of instruments for your inspection, of heroic size. They are exact models, in brass, of those instruments each student is required to obtain upon entering the class. These can be seen readily from any point in the class room when held up to view. They can be used by the instructor as object lessons, allowing the student's eye to become familiar with their forms, manner of grasping, and work expected of such and such forms, by the teacher excavating cavities in large models of clay. The nomenclature of their different parts are designatd in the following manner.

Excavators.

1st. The *shaft* is that portion of the instrument intended to be held in the hand—the handle.

2d. The *shank* is that portion between the shaft or handle and the last angle or curve leading toward the working point.

3d. The *blade* is that portion beyond the last angle or curve ending in the working point.

4th. A. The *length* of the blade is measured from the last angle or curve to the working point or edge.

B. The *width* is measured parallel with or from end to end of the working point or cutting edge.

5th. The *cutting edge* constitutes the working point and is made by beveling one or both sides of the blade its entire width.

6th. A. *Single plane* instruments may have one or more angles or curves and will lie flat on a flat surface, every part touching the surface or plane.

B. *Double plane* instruments are those that have the last angle or curve on a plane which is at a right angle, or nearly so, to the principal plane. These are made in pairs and termed "rights and lefts."

So far, all is well, but for the systematic naming and classification, an appeal was made to the *father of technics*, Doctor Black, and he, like a noble councilor, always comes to the rescue with something good, reasonable and practicable.

The following is an abstract of a system of instrumentation prepared by Prof. Black, in the year 1893, for the use of the operative technic course in the N. W. U. D. S.

When we consider the time dental instruments have been in use, and the importance attached to them, together with the great care bestowed upon their construction, and considering the great value to the dental profession of a systematized nomenclature for dental instruments, it is a matter of wonder that so few names have been developed. At the present time there is no teacher who can convey to his pupil a definite idea in words of the instruments he would use in a given operation. This in itself is sufficient to account for the great diversity in instrumentation among dentists, and the difficulty so keenly felt in teaching instrumentation.

The laws of usefulness of the patterns belonging to the several orders of dental instruments are not over difficult of discovery, and upon these a system of classification and nomenclature may be founded that would answer the purpose of bringing order out of the present chaos.

This classification is based upon the usage of writers, and is a brief explanation of the uses they have made of the many names applied to instruments.

The classification is made to enable the student to systemize in his mind the many forms of instruments, and the uses of the names he may hear or learn and more readily understand their meaning. In the definitions which follow this classification its uses will become apparent.

In searching the literature with the object of discovering the laws that have governed the formation of the names that we now have of dental instruments, it seems that four points have been used.

This will be best illustrated by the following classification, each division of which seems to have served as a distinction in the development of names:

1st. Orders; 2nd. Sub-orders; 3rd. Class; 4th. Sub-class.

It should be remembered that this classification has reference to the names by which instruments are already known.

1st. *Order* names describe the use of the instrument — as excavator, plugger, scaler, accessories.

When the term direct cutting or lateral cutting instrument is used (rights and lefts,) it becomes sub-order naming.

2nd. *Sub-order* names describe the manner or purpose of the use of instruments—as direct cutting or lateral cutting excavators, hand plugger, mallet plugger, gold plugger, amalgam plugger, push or pull scaler.

3rd. *Class* names describe the working point or end of the instrument—as hatchet, hoe, spoon, discoid, cleoid, excavators; round, square, triangular or oblong pointed plugger; flat or plain faced, convex faced, plano-convex faced pluggers, or smooth faced, serated faced pluggers.

When the term lateral or side curved instrument is used it becomes sub-class naming.

4th. *Sub-class* names describe the angles or curves leading to the working point—as obtuse angle, right angle, acute angle or curve; mon-angle, bin-angle, triple angle hatchet or hoe; contra-angled instruments, bayonet pluggers, spiral pluggers.

Occasionally two or more sub-order or class names are applied to the same instrument, as mallet gold plugger, serated flat or plane faced plugger, or smooth convex-faced plugger. Accessories will, however, remain as important adjuncts or helps—as separator, broaches, clamps, matrices, saws, files, etc.

Among the names developed in usage some confusion appears that needs correction. In some cases this may be done by designating the name most appropriate for continued use and dropping the others. In other cases several forms have been designated by the same name. In these it will be necessary to give strict definitions by which the name may be confined to a particular form, and when practicable assign a new name to those forms that are in this way left without names.

A BLACKBOARD OBJECT LESSON.

	ORDER.	SUB-ORDER.	CLASS.	SUB-CLASS.
Order........	Excavators.	Direct cutting.	Hatchet. Hoe. Spoon.	Obtuse, R. or A. angle. Contra, triple angle.
		Lateral cutting (rights and lefts.)	Hatchet. Hoe. Spoon.	Double plane or Lateral curve, (rights and lefts).
	Pluggers.			
	Scalers.	Push, Pull, or Hoe.	Sickloid. Cleoid.	
	Accessions.			

Sub-order...
- Direct cutting.
- Lateral "
- Hand plugger.
- Mallet "
- Gold "
- Amalgam "

Class..........
- Hatchet ex.
- Hoe "
- Spoon "
- Discoid "
- Cleoid "
- Smooth-faced plugger.
- Serated " "
- Flat " "
- Convex " "

Sub-class....
- Obtuse angle.
- Right "
- Acute "
- Mon "
- Bin "
- Triple "
- Contra "
- Single plane (rights and lefts).
- Double plane

ORDER.	SUB-ORDER.	CLASS.	SUB-CLASS.
1. Excavator.	Direct cutting.	Hatchet.	Obtuse mon-angle.
2. "	"	Hatchet.	Right mon-angle.
3. "	"	Hatchet.	Acute mon-angle. (or over-curve).
4. "	"	Hatchet.	Contra triple angle.
5. "	"	Hoe.	Right mon-angle.
6. "	"	Discoid hoe.	Obtuse mon-angle.
7. "	"	Cleoid hoe.	Obtuse mon-curve.
8. "	"	Chisel.	Straight.
9. "	"	Chisel.	Obtuse mon-curve.
10. "	"	Enamel bevelers.	Obtuse mon-angle.
11. "	"	Enamel bevelers.	Right mon-angle.
12. "	"	....	....

Metallurgy Technics.

BY C. L. GODDARD, A. M., D. D. S.
University of California, College of Dentistry.

Our laboratory work, or technic work in metallurgy, has been of gradual growth and might still be much improved. We use a laboratory in connection with the instructor of chemistry, though a separate one would be better.

A separate bench is provided for each student, fitted with shelves, and the usual chemical reagents, including HCl, HNO_3, H_2SO_4 etc. To these are added bottles containing sheet lead and tin, granulated zinc, iron (tacks), carbonate of soda, carbonate of potash, nitrate of potash, sodium chloride, chloride of ammonium, bichloride of mercury (crystals), sulphur, caustic potash (sticks), etc.

Each bench is provided with a piece of very heavy sheet iron, about one-sixteenth inch thick, about 14x24 inches, to protect the wood work in using gas furnace, etc. This is varnished with shellac to prevent rust.

Other tables are provided for general use and for clinics. These are covered with cement.

Each student's bench has a gas cock and Bunsen burner. Fletcher's crucible furnaces and gas stoves are furnished for melting, alloying and refining.

Tongs, small ladles, test tubes, racks and tube holders, ingot moulds, moulding sand, evaporating dishes, etc., are provided; also the metals in bulk or bars, such as lead, zinc, tin, cadmium, etc.

The accompanying pages, printed on the mineograph, are samples of the work done with the different metals. As no book has been issued for such a course, we have had to devise our own plan. It is not presented as a model, but as a beginning from which others may evolve a better course. Some things may have been required that were not essentials Others may be added with advantage.

I send with this one large card, showing bars of different metals of the same size and weight, but varying in length according to specific gravity, all the work of our students. I send also a pamphlet containing examples to be worked according to Prof. Watts' well known rules for computing and compounding alloys. I have found the plan a good one, as rules are best learned by examples worked upon the board.

Dental Metallurgy—Laboratory Course College of Dentistry, University of California.

BY C. L. GODDARD, A. M., D. D. S.

Examine the following metals, note their general appearance and fill out the table:

	Color.	Mal.	Duc.	Ten.	f. p.	s. g.	Conductor of Heat.	Conductor of Elect.	Expan.	Noble or Base.
Au.										
Zn.										

Other metals which it is desirable to have examined should be tabulated under these same headings; as, Hg. Cu, Fe, etc.. etc.

Specific Gravity: Make a bar of each of these metals, 2 oz. in weight, to show comparative specific gravity.

(Each student may make a bar of a different metal, in wire ingot mold.)

Blow-pipe Experiments.

Examine Bunsen burner flame and blow-pipe flame. Produce oxidizing and reducing flame with blow-pipe.

Blow-pipe Tests of the Metals.

Heat a small piece of each of the following metals on charcoal.

Zn. in O. Fl. burns with a blue flame and forms a film of oxide (Zn O) yellow when hot, white when cold.

Pb. in O. Fl. forms a yellow film of oxide (PbO) Sn. in O. Fl. forms a white film of oxide ($Sn. O_2$) Cd. in O. Fl. burns with a dark yellow flame and forms a brown film of oxide, reddish brown when cold; in thin layers, orange yellow.

Sb. in O. Fl. forms a white film of oxide. The bead remains a considerable time in a state of ignition without the blp. giving off a thick white smoke, which is partly deposited on the ch. in white crystals.

Bi. in O. Fl. forms a film orange yellow when hot, and lemon yellow when cold; usually surrounded by a white film of carbonate.

Make plate and solder as follows:

1. *Gold Plate, 18^k^.*

(a) Au.	18 dwts.	or	(b) U. S. Gold Coin,	20 dwts.
Cu.	4 "		Cu	2 "
Ag.	2 "		Ag	2 "

2. *Gold Plate, 18^k.*

U. S. Gold Coin, \$20.00 = 516 grs.
U. S. Silver Coin, .25 = 96.45 grs.

3. *Gold Plate, 20^k* (4) *20^k +*

Au.	20 dwts.	U. S. Gold Coin,	\$20.00.
Cu.	2 "	U. S. Silver Coin,	.10.
Ag.	2 "		

5. *Clasp Gold, 20^k.*

U. S. Gold Coin, 20 dwts.

Cu.	8 grs.
Ag.	10 "
Pt.	20 "

6. *Crown Gold, 21.6^k* (Color of Pure Gold.)

(*a*) Au.	90 parts, or	(*b*) Gold Coin	50 parts.
Cu.	5 "	Au.	45 "
Ag.	5 "	Ag.	5 "

7. *Gold Solder, 18^k* (Use on 18^k Plate or Crown Work.)

(*a*) Au.	27 parts,	or (*b*) U. S. Gold Coin	30 parts.
Ag.	4 "	Ag.	4 "
Cu.	4 "	Cu.	1 "
Brass	1 "	Brass	1 "

8. *Gold Solder, 18^k*

(*a*) Gold Coin	5 parts,	or (*b*) Gold Coin	5 parts.
Silver Solder	1 "	Brass	1 "

9. *Gold Solder, 15^k*

Gold Goin	6 dwts.
Ag.	30 grs,
Cu.	20 "
Brass	10 "

10. *Gold Solder 20^k* (For Crown and Bridge Work.)

U. S. Gold Coin. \$10.00 = 258 grs. or 12 parts.
Spelter Solder. (Cu.1+Zin1) 20.64 or 1+ "

11. *Silver Plate.* *Coin Silver.*

(*a*) Ag. 1 dwt.	(*b*) Ag. 9 parts.
Pt. 3 to 10 grs.	Cu. 1 "

12. *Silver Solder.*

(*a*) Ag.	6 dwts.	(*b*) Coin Silver	5 parts.
Cu.	2 "	Brass	1 "
Brass	1 "		

(*c*) Soft Silver Solder.

Ag.	32 parts.
Brass	32 "
Sn.	2 "

Dental Metallurgy. Gold Au.

Each student will need gold, pure coin, or scraps in amount equal to $2.50 piece.

1. Weigh scraps or mass of gold.
2. Melt on *ch* or *pad* and test its malleability.
3. Melt and add small piece of Pb, Sn, Zn, Sb or Aml.
4. Test its malleability.

Refining Brittle Gold by Roasting.

5. (If filings or small scraps, pass magnet through to remove steel or iron filings.)
6. Line a crucible with borax.
7. (If filings, melt with carbonate of potassium.)
8. Melt ingot or scraps with borax and KNO_3 for 10 m to ½ hour, adding KNO_3 occasionally.
9. Cool and break crucible, and test button for mal.
10. If mal, melt in new crucible and pour into ingot mold previously oiled and warmed.
11. Roll into plate No. 26.
12. If still brittle, melt with fine *ch* and NH_4Cl (or with $HgCl_2$ or NaCl).
13. If still brittle, melt with S.
14. If still brittle, begin again with No. 8 and proceed as before, but roast a longer time.

Quartation Method of Refining Gold.

15. To mass of gold add three times its weight of Ag (pure or coin).
16. Melt in cru, then granulate or roll to No. 30.
17. Add HNO_3, 1½ weight of alloy or 2½ times weight of H_2SO_4. (Use a flask and heat in evaporating chamber).
18. After action ceases add a little more acid, stronger if possible, and heat again.
19. Gold settles at the bottom, pour off liquid and preserve for separating Ag.
20. Melt the gold and form button or ingot.

Wet Method of Refining.

21. Dissolve in aqua regia (2 or 2 HCl + $1HNO_3$).
22. AgCl settles as precip, remove by pouring or filtering.
23. Dilute and evaporate by low heat to consistency of syrup two or three times to remove excess of aq regia, but add a little HCl to prevent immediate precipitation of Au. If AgCl is precipitated during evaporation, remove by decantation or filtering.

24. Dilute and add solution of ferrous sulphate or oxalic acid.
25. After precip, Au settles as brown powder or yellow scales.
26. Filter and test filtrate with fer sul. If brown precip appears and disappears, free aq reg is present,—evoporate.
27. Dry the gold and melt in cru with borax and carbonate of potassium.
28. (If gold is precip with fer sul, wash precip with water and heat with H_2SO_4 to remove traces of Fe).

Silver, Ag. F. P. 1873° F. Sp. Gr. 1053.

1. *Solubility.* Test with HCl, HNO_3 and H_2 SO_4.
   (*a*) $Ag + HCl = AgCl + H$. Slightly soluble.
   (*b*) $Ag + 2HNO_3 = AgNO_3 + H_2O + NO_2$.
   or $3Ag + 4HNO_3 = 3AgNo_3 + 2H_2O + NO$.
   (*c*) $2Ag + 2H_2SO_4$ (hot) $= Ag_2SO_4 + 2H_2O + SO_2$.
2. *Reduction.*
   (*a*) Reduce $AgNO_3$ or Ag_2SO_4 to metallic silver with Cu. (First drive off free acid by evaporation.)
   $2AgNO_3 + Cu = Cu\ (NO^3)_2 + 2Ag$.
   $Ag_2SO_4 + Cu = CuSO_4 + 2Ag$.
   (*b*) Dilute AgNO or Ag_2SO_4 and reduce to AgCl by adding NaCl.
   $AgNO_3 + NaCl = AgCl + NaNO_3$—$Ag_2SO_4 + 2\ NaCl = 2AgCl + Na_2SO_4$.
   (*c*) Filter and test filtrate for Ag by adding NaCl.

If a precipitate is formed add more NaCl, slowly, till no further precipitation takes place. Avoid excess of NaCl, as AgCl is soluble in it. (Filter and test again.)

(*d*) Wash precipitate (AgCl) till filtrate shows no blue color with ammonium. (= Test for Cu.)

(*e*) Reduce AgCl with Fe, water and HCl.
$Fe + 2HCl = FeCl_2 + 2H$; $2H + 2AgCl = 2HCl + 2Ag$.

(*f*) Reduce AgCl with Zn, water + H_2SO_4.
$Zn + H_2SO_4 = ZnSO_4 + 2H$; $2H + 2AgCl = 2Ag + 2HCl$.

Wash precipitated Ag with hot water, acidulated with HCl, two or three times, then with hot water alone.

Melt with potassium carbonate.

(*g*) Reduce AgCl with potassium carbonate. (In crucible lined with borax.)

(*h*) Reduce AgCl with sodium carbonate $2AgCl + Na_2\ CO_3 = Ag_2 + 2NaCl + O + CO_2$.
$2AgCl + K_2CO_3 = 2Ag + 2KCl + O + CO^2$.

(*i*) Reduce AgCl (100) in crucible with chalk (70.4) and charcoal (4) $2AgCl + CaCO_3 = 2Ag + CaCl_2 + CO_2 + O$.

3. *Test Mal.* *Duc.* *Ten.*
4. *Alloys.* *Plate.* *Solder.*

(*a*) Ag 9 + Cu 1.	(*c*) Ag 6 + Cu 2 + Brass 1.
(*b*) Ag 1 dwt + Pt 3—5 grs.	(*d*) Coin Silver 5 + Brass 1.

e Soft Silver Solder, Ag 32 + Sn 2 + Brass 32.

5. *Tests for Ag in solution.*
   (*a*) Chlorides and Cl precipitate AgCl—white.
   (*b*) H_2S forms black precip insol in dilute acids or alkalies Ag_2S.
   (*c*) Ammonia forms a brown precip soluble in excess.
   (*d*) Potassa forms a brown precep insol in excess.
7. *Assaying Plate or Coin.*
   (*a*) Weigh assay.
   (*b*) Mix with four or five times its weight of pure Pb.
   (*c*) Heat in cupel in muffle or with blowpipe in O fl till Pb is oxidized and sinks in cupel and bright button of Ag remains.
   (*d*) Weight of assay—weight of button = amount of alloy.
8. Vulcanize a piece of rubber in contact with silver.
   Result: Hg attracts S from rubber and prevents hardening.
   $2Ag + S = Ag_2S$.

Zinc, Zn. F. P. 773° F. Sp. G. 6.8–7.2.

1. *Reduction.*
   (*a*) Roast fragments of zinc, carbonate $Zn CO_3 + H_2O_2$ in crucible to expel $H_2O + Co_2$.
   (*b*) Mix ore thus, obtained with ch in test tube and heat full red heat. Reaction $Zn Cl = Zn + Cl_3$. Zn condenses on side of tube.
   (*c*) In crucible place Zn O + Ch pulv. Heat to redness and obtain Zn.
   (*d*) Melt old partially oxidized Zn (Zn + ZnO) under Ch to remove oxide.
2. *Solubility.* Test with HCl, HNO_3, H_2SO_4.
   (*a*) $Zn + 2 HCl = Zn Cl_2 + H$. From a hot Sat Sol crystals will form. Solution used in soft soldering and making oxychloride of Zn cements. (Preserve for future use.)
   (*b*) $Zn + 2 HNO_3 = Zn2NO_3 + 2H$.
   (*c*) $Zn + 2 H_2 SO_4 = Zn SO_4 + 2H$. Chrystalizes (white vitriol) isomorphus with $Mg SO_4$ (Epsom Salts).

3. *Test.* *Mal.* *Duc.* *Tn.* See table and mark accordingly.
4. *Heat to 248 or 302° F, test malleability.*
5. *Heat to 400° F.* Powder in morter or iron ladle (use Sn for test).
6. *Heat Zn in crucible 1900° F. forms oxide ZnO.* (Preserve.)
7. *Alloy.* (*a*) Melt Zn 3oz + Sn 1 oz (for Small die).
   (*b*) Melt Zn 2 oz Pb 2 oz (cast in long ingot, or let cool in crucible Zn and Pb separate, and may be sawed apart.
   (*c*) Melt $Zn_1 + Cu_2$ under ch forms brass, (alloys better if old brass is added).
   (*d*) Make alloy of $Brass_2 + Zn_1$ = Solder for brass.
   (*e*) Amalgamation Zn + Hg unite readily, especially if heated. (If surface of Zn is tarnished, clean with dilute H_2SO_4 or heat to 500° F. and brush surface.
8. *Zinc Cement.* (*a*) Mix $ZnO + ZnCl_2$ (solution) oxychloride of zinc — $3ZnO + ZnCl_2(H_2O) = ZnCl_2, 3ZnO(H_2O)$.
   (*b*) Dissolve glacial phosphoric acid in distilled H_2O and evaporate to consistency of glycerine.
   (*c*) Mix ZnO and (b) = oxyphosphate of Zinc. $ZnO + HPO_3 (H_2O) = ZnO, HPO_3(H_2O)$.

   For improvements in zinc cements see Flagg or Essig.
9. *Blow-pipe Analysis.*
   (*a*) Heat small piece of Zinc on ch with blp. Blue flame, film of oxide, yellow when hot, white when cold.
   (*b*) Moisten the coal in front of the assay with solution of cobalt nitrate, apply strong R Fl. The coal will be bright yellow green when cold; or moisten the film of oxide obtained in (a) with cobalt nitrate and apply R Fl with same result.

   Interfering elements Sb, Cd, Pb, Bi, and Sn.

1. *Tests for Zinc in Solution.*
   (*a*) Add caustic pottash = white precp sol in excess.
   (*b*) " " soda " " " " "
   (*c*) " ammonia " " " " "
   (*d*) " ammonium sulphide white precp insol in caustic alkalies.

Tin. Sn fp 442° F, s. g. 7.3.

1. *Reduction.*
   (*a*) Roast tin ore (cassiterite) SnO_2 in crucible with *ch;* $SnO_2 + C = Sn + CO_2$.
   (*b*) Roast oxide of tin (SnO_2) in crucible with *ch;* $SnO_2 + C = Sn + CO_2$.

(c) Heat SnO_2 ore *ch* with sod carb in *R Fl.* A globue of ti results. (Sod carb protects the reduced metal from oxida tion.)

2. *Solubility.*—Test with hydrochloric, nitric and sulphuric acids aqua regia and caustic alkalies.
   (a) $Sn + 2HCl = SnCl_2 + 2H$. (Preserve.)
   (b) $3Sn + 4HNO_3 = 3SnO_2 + 4NO + 2H_2O$.
   (c) $Sn + H_2SO_4 = SnSO_4 + 2H$.
   (d) $Sn + 4HCl + 2HNO_3 = SnCl_4 + 3H_2O + N_2O_3$. (Pre serve.)
   (e) $Sn + 2HKO = Sn\ (KO)_2 + 2H$.
3. *Test mal.* *duc.* *ten.* (See table.
4. *Alloys.* Make the following, viz:—
   (a) Haskell's Babbett metal for dies, Sn 8, Sl 2, Cu 1.
   (b) Newton's alloy ("Mellott's metal"), Sn 3, Pb 5, Bi 8, f p 292° F.
   (c) Hodgen's alloy for dies and counters, Sn 3, Pb 5, Bi 8, Sb 2
   (d) Richmond's alloy for dies and counters, Sn 20, Pb 19, Cd 13, Bi 48, f p 150°F.
   (e) Kingsley's alloy for Inf Dentures, Sn 16 + Sb 1.
   (f) Bean's alloy for Inf Dentures, Sn 95, Ag 5.
   (g) Soft solder and fusible metals (see Lead).
5. *Amalgamation.* Test by rubbing Hg on Sn.
6. *Blowpipe Analysis.*
   (a) Heat tin on ch in *O Fl*—white film of SnO_2.
   (b) Moisten with cobalt nitrate and apl *O Fl*—bluish green.
7. *Tests in Solution.*
   (a) Add caustic potash, white precip sol in excess.
   (b) Add caustic soda, white precip sol in excess.
   (c) Add ammonia, white precip insol in excess.
   (d) Add Am sulf or H_2S to $SnCl_2$, brown precip sol in excess.
   (e) Add Am sulf or H_2S to $SnCl_4$, yellow percip sol in excess.
   (f) Add $AuCl_3$ gives purple precip Purple of Cassius.
   Better if both $SnCl_2$ and $SnCl_4$ are present, thus:
   Add $SnCl_4$ to $AuCl_3$, then add this to $SnCl_2$.
   $2AuCl_3 + 3SnCl_2 = 3SnCl_4 + 2Au$ combined with a small amount of some salts of tin.
8. *Electro Deposit of Tin.*
   (a) Immerse a bar of tin in a strong sol of $SnCl_2$.
   (b) Pour water on carefully, so as not to disturb the tin sol.
   (c) Pure tin will be deposited on the bar at the point of junc tion of the water and the tin solution.

9. To coat small articles of copper or brass with *tin*, place them in layers between sheets of grain tin, in a satuated solution of cream of tartar (potassium bitartrate, KH ($C_4H_4O_6$), and boil the solution. A little stannous chloride may be added if necessary.

Lead. F. P., 617°F. S. G. 11.3.

1. *Reduction.*
   - (*a*) Heat Galena (PbS) with iron or in an iron ladle. — $PbS + Fe = Pb + Fe S$.
   - (*b*) Heat Galena on *ch* with sodium or potassium carbonate—
     $Pb S + Na_2CO_3 + C = Pb + Na_2S + Co_2 + Co$.
     $Pb S + K_2CO_3 + C = Pb + K_2 S + CO_2 + CO$.
   - (*c*) Heat litharge (PbO) to read heat, exposed to air. Result, red oxide of lead -- $3PbO + O = 2 PbO + PbO_2$.
   - (*d*) Heat *Litharge* in *R Fl* on *ch*—Result Pb.
   - (*e*) Melt old, partially oxidized lead in ladle under powdered *ch*, and obtain metallic lead.
2. *Solubility.*
   Test with hydrochloric, nitric, sulphuric and acetic acids.
   - (*a*) $Pb + 2HCl = Pb Cl_2 + H$ (Slightly sol). $PbCl_2$ is best made by adding HCl to strong sol of lead nitrate.
   - (*b*) $3 Pb + 8 HNO_3 = 3 Pb (NO_3)_2 + 2 NO + 4 H_2O$ (Preserve). Lead nitrate also made by dis lead oxid or carb in HNO_3.
   - (*c*) Lead is only attacked by hot concentrated H_2SO_4 $Pb + 2H_2 SO_4 = Pb_1SO_4 + SO_2 + 2 H_2O$.
   - (*d*) $Pb + O + HC_2H_3O_2 = Pb (C_2H_3O_2)_2 + H_2O$.

   Lead acetate is best formed by dis PbO in acetic acid.
3. *Test.* *Mal.* *Duc.* *Ten.*
4. *Alloys.*
   - (*a*) Haskell's alloy for counter dies, Pb 5 + Sn 1.
   - (*b*) Soft Solder, Fine Pb 1 + Sn 2, fp, 340° F.
     Common Pb 1 + Sn 2, fp, 370° E.
     Coarse Pb 2 + Sn 1, f. p., 440° F.
   - (*c*) Fusible Alloys. (1) Pb 1 + Sn 1 + Bi 2, fuses at 200° F.
     (2) Pb 2 + Sn 1 + Bi 3, fuses at 200° F.
     Wood's metal (3) Pb 1 + Cd 1 + Bi 7, fuses at 180° F.
   - (*d*) Melt together Pb 1 + Zn 1 (See Zinc No. 7) Pb + Zn separate.
5. *Repair a vulcanite denture with fusible alloy*—cut dove-tailed spaces for pins of teeth and melt in pieces of fusible alloy with hot burnishers.

6. *Amalgamation.*

 Test by rubbing Hg on lead.

7. *Blow-pipe Analysis.*

 (*a*) Pb on *ch* O Fl forms yellow film of oxid.

 (*b*) Pb on plaster in O Fl forms chrom yellow film.

8. *Tests for Lead in Solution,*

 (*a*) Add caustic potash, white precip, sol in excess.

 (*b*) Add ammonia, white precip, sol in excess.

 (*c*) Add ammonium sulphide or H_2S, black insol, in excess.

 (*d*) Add alkaline carbonates, forms white precip, which is blackened by H_2S.

9. *Electro Metallurgy.*

 In a dilute solution of lead nitrate or acetate suspend a piece of zinc—a lead tree is formed.

 $Zn + Pb\,2\,NO_3 = Pb + Zn\,2\,NO_3$ or —

 $Zn + PbC_2H_3O_2 = Pb + Zn\,C_2H_3O_2$.

(Let all the class put their lead nitrate (See 2 b) in one large bottle, and their lead acetate (2 d) in another. Suspend a piece of zinc in each and let stand till tree forms.

Rules for Computing and Compounding Gold Alloys, with Examples.

I.

To ascertain the carat of any given alloy, the proportion may be expressed as follows:

"As the weight of the alloyed mass is to the weight of gold it contains, so is 24 to the standard sought."—Prof. Geo. Watt.

Example.—Gold 6 parts, silver 2 parts, copper 1 part; total, 9 parts.

$$9 : 6 :: 24 : ?$$

$$\begin{array}{r|l} & 6 \\ 9 & 144 \\ \hline & 16 \text{ Answer.} \end{array}$$

Another method when alloyed gold is used in forming the mass, instead of pure gold, is to express the proportion as follows:

As the weight of the alloyed mass is to the weight of the gold alloy used in its composition, so is the carat of the latter to the carat of the former.

Example.—Harris No. 1 solder.

22-carat gold,	48	parts.
Copper,	16	"
Silver,	12	"
Total,	76	"

76:48::22^k

Answer, 13.9^k.

EXAMPLES UNDER RULE I.*

1. Find the carat of 36 dwts Au, 8 dwts Cu, 4 dwts Ag. Ans., 18^c.
2. " " 9 dwts Au 2 dwts. Ans., 18^c.
3. " " 38 dwts Au, 6 dwts Cu, 4 dwts Ag. Ans., 19^c.
4. " " 22 dwts Au, 1 dwt Cu, 18 grs Ag, 6 grs Pt. Ans., 22^c.
5. " " 22 dwts Au, 2 dwts Cu, 1 dwt Ag, 1 dwt Pt.
6. " " 6 dwts Au, 2 dwts Cu, 1 dwt Ag.
7. " " 48 parts of 22^c gold, 16 pts Ag, 12 pts Cu. Ans., 13.9^c.
8. " " 20 dwts of gold coin, 2 dwts Cu, 2 dwts Ag. Ans., 18^c.
9. " " 20 dwts of gold coin, 25 grs Cu, 40 + grs Ag.
10. " " 20 dwts of gold coin, 18 grs Cu, 20 + grs Ag.
11. " " 46.44 grs Au, 5.16 grs Ag, 46.44 grs Cu.

II.

To reduce pure gold to any required carat, the proportion may be expressed as follows:

"As the required carat is to 24, so is the weight of gold used to the weight of the alloyed mass when reduced. The weight of gold subtracted from this gives the quantity of alloy to be added." —Prof. Geo. Watt.

Example.—Reduce 6 oz of gold to 16 carat: 16:24::6 oz: 9 oz; 9–6 = 3 oz alloy to be added.

To reduce gold from a higher carat to a lower carat, the proportion may be expressed as follows:

As the required carat is to the carat used so is the weight of the mass used, to the weight of the alloyed mass when reduced.

*Richardson, p. 59; Essig, p. 131; Harris, p. 550.

The weight of the mass used subtracted from this gives the quantity of alloy to be added.

Example:—Reduce 4 oz. of 20 carat gold to 16 carat:

$$16 : 20 :: 4 \text{ oz} : ?$$
$$\begin{array}{r} 4 \\ \hline 16)\overline{80}(5 \text{ oz.} \end{array}$$

5 oz — 4 oz = 1 oz alloy to be added.

EXAMPLE UNDER RULE II.

1. Reduce 6 oz gold to 16 carat.
   Ans., Add 3 oz alloy.
2. Reduce 25 dwts gold to 18 carat.
   Ans., Add 8 dwts. 8 grs. alloy.
3. Reduce 4 oz, of 20 carat gold to 16 carat.
   Ans., Add 1 oz. alloy.
4. Reduce 6 oz of 18 carat gold to 15 carat.
5. Reduce 15 dwts of gold coin to 20 carat.
   Ans., Add 1.2 dwts.
6. Reduce 12 dwts of gold coin to 18 carat.
7. Reduce 4 dwts of 22^cAu to 20 carat.
   Ans., Add 9.6 grains alloy.
8. Reduce 48 grs 20^cAu to 16 carat.
9. Reduce 2 dwts 20^cAu to 18 carat.
10. Reduce 1 dwt 8 grs 18^cAu to 16 carat.

III.

To raise gold from a lower to a higher carat, add pure gold or a finer alloy.

"As the alloy in the required carat is to the alloy in the given carat, so is the weight of the alloyed gold used to the weight of the alloy required.

"The weight of the *alloyed gold used* subtracted from this gives the amount of pure gold to be added."—Prof. Geo. Watt.

Example.—Raise one dwt of 16 carat gold to 18 carat. First subtract 16 and 18 from 24 to find the amount of alloy in each carat.

$$\begin{array}{ccccl} 24 & & 24 & & \\ 18 & & 16 & & \\ \hline 6 & : & 8 & :: & 1 \text{ dwt} : ? \\ & & 1 & & \\ & 6) & 8 & & \\ \hline & & 1\frac{1}{3} & & \end{array}$$

$1\frac{1}{3} - 1 = \frac{1}{3}$ dwt pure gold to be added.

To change gold from a lower carat to a higher carat, by adding gold of a still higher carat:

Subtract the lower carat and the required carat each from the highest carat (instead of from 24) and proceed as before.—Prof. Watt.

Example.—Raise 2 dwt of 16 carat gold to 18 carat, by adding 22 carat gold.

First subtract 16 and 18 from 22.

$$\begin{array}{r} 22 \\ \underline{18} \\ 4 \end{array} : \begin{array}{r} 22 \\ \underline{16} \\ 6 \end{array} :: 2 \text{ dwt} : 3 \text{ dwt}$$

3 — 2 = 1 dwt of 22 carat gold to be added.

EXAMPLE UNDER RULE III.

1. Change 2 dwt. of 16 carat Gold to 18 carat.
   Ans. Add 8 grs. Au.
2. Change 2 oz. of 16 carat Gold to 20 carat,
   Ans. Add 2 oz Au.
3. Change 11 dwt 8 grs of 18^c Gold to 20 carat.
4. Change 9 dwt of 16^c Au to 18 carat.
   Ans. Add 3 dwts Au.
5. Change 2 oz of 20^c Au to 22 carat.
6. Change 18 dwt of 16^c Au to 18^c by adding 22^c Au.
   Ans. Add 9 dwts of 22^c Au.
7. Change 3 dwts of 18^c Au to 20^c by adding Gold coin.
   Ans. Add 3 dwts 18 grs.
8. Change 12 dwts 10 grs of 16^c Au to 20^c by adding Gold coin.
9. Change 20 grs 16^c Au to 18^c by adding 20^c Au.

MISCELLANEOUS EXAMPLES.

1. Find the carat of 19 dwts Au 3 dwts Cu, 2 dwts Ag.
   Ans. 19^c
2. Reduce 5 dwts 4 grs Au to 20^c.
3. Reduce 2 oz 4 dwts 8 grs to 20^c Au to 18^c.
4. Change 12 dwts 18^c Gold to 20^c.
   Ans- Add 6 dwts Au.
5. Find the carat of 20 pts Gold coin 3 pts Cu, 3 pts Ag (Gold plate).
6. Find the carat of 30 pts Gold coin, 1 prt Cu, 4 pts Ag, 1 prt brass (solder).
7. Reduce 258 grs Gold coin to 20^c Au.
8. Reduce 516 grs Gold coin to 18^c Au.
9. Change 4 dwts 16^c Au to 18^c by adding Gold coin.

10. Change 3 dwts 6 grs 16^c Au to 18^c by adding 20^c Au. ($10.00 Gold coin weighs 258 grs—$0.10 Silver coin 38.58 grs.)

11. Add $20.00 Gold to 10 cents Silver—find weight and carat.

12, Add $20.00 Gold to 25 cents Silver—find weight and carat.

13. Change $\left\{\begin{array}{rl} \text{Gold coin} & 20 \text{ dwts} \\ \text{Cu} & 2 \text{ “} \\ \text{Ag} & 2 \text{ “} \end{array}\right\}$ to formula for pure gold, and find carat.

14. “ $\left\{\begin{array}{rl} \text{Gold coin} & 20 \text{ dwts} \\ \text{Cu} & 25 \text{ grs} \\ \text{Ag} & 40+\text{grs} \end{array}\right\}$ do

15. “ $\left\{\begin{array}{rl} \text{Gold coin} & 20 \text{ dwts} \\ \text{Cu} & 18 \text{ grs} \\ \text{Ag} & 20+\text{grs} \end{array}\right\}$ do

16. “ $\left\{\begin{array}{rl} \text{Au} & 18 \text{ dwts} \\ \text{Cu} & 4 \text{ dwts} \\ \text{Ag} & 2 \text{ dwts} \end{array}\right\}$ to formula for Gold coin, and find carat.

17. A watchchain 14 carats fine, weighs 2 oz 4 dwts 16 grs. How much pure gold must be added to raise it to 20 carat gold?

18. A piece of jewelry 12 carats fine weighs 3 dwts. How much U. S. gold coin must be added to make it 18 carats fine?

19. Add 4 oz 16 dwts 5 grs of 14 carat gold to 2 oz 4 dwts 16 grs of 16 carat gold and find the carat of the mixture.

Ans. 7 oz 21 grs of 14.64 carat gold.

20. How much pure gold must be added to the above mixture to make it 18 carats fine?

21. How much U. S. silver coin, and how much copper must be added to 3 oz U. S. gold coin, to reduce it to 18 carat gold containing equal parts of silver and copper?

Orthodontia and Crown and Bridge Technics.

BY C. M. BAILEY.

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Formerly it was the custom to induct candidates into any one of the mechanical callings through a course of apprenticeship to some master. This apprenticeship was for seven years in the ordinary trades, and engrossed the whole time of the candidate. Gradually the time was shortened, until, under the influences of causes which it is not necessary to detail, skilled workmen were difficult to find, and, with very few exceptions, we have been dependent here in the United States upon foreign-born and trained mechanics for all our skilled work. Those few exceptions have been made up of men

who were endowed with capabilities for self-instruction; and the meagre and imperfect facilities afforded by the shops of the United States have been supplemented by evening work and study at home.

Very much the same has been the course of things in dentistry. First we had private tutelage, and, later, when it became evident that a dentist needed something more than finger dexterity, and that a knowledge of the body upon which he worked, in health and disease, was also needed, there came the dental college; but in the college there was not provided the required training for the fingers; it was assumed that the student would still have the benefit of private tutelage. In the course of time this, however, so far as our better offices are concerned, has ceased, and it now becomes of the first importance to supply that loss to those who may seek entrance to the profession. The technic courses in our several colleges are the attempt to meet this demand.

Recognizing the primary lack of fingercraft in our students, as well as a knowledge of those operations peculiar to our work, the courses in this school in crown and bridge and orthodontia technics have attempted to meet both these needs. The course in orthodontia has been running in the school for three years, and much of its value has been due to the efficiency and enthusiasm of my assistant, Dr. G. S. Monson. The course in crown and bridge work was devised and put into operation by Prof. F. B. Kremer last year for the first time, and the writer wishes to disclaim any credit for either its arrangement or execution in our school. The materials used by him are high brass, 29 and 30 gauge, and silver solder and hard wood blocks. In the orthodontia technics the materials used are 18 per cent German silver wire and plate, Stubbs' steel rods and No. 9 piano wire.

In planning the courses the effort was made to bring them within the compass of tools needed in the laboratory for other purposes. This has been successful in so far that only a drawplate, a screwplate, and a large pliers with side cutters for wire are required for the orthodontia technics, and two contouring pliers in the crown and bridge course.

The course in crown and bridge technics is covered in nine items:

1. Molar and bicuspid crowns carved in hard wood.
2. Metal shell crown, molar.
3. Richmond crown, cuspid.
4. Logan crown, (banded).
5. Metal shell crown, removable porcelain face.

6. Molar dummy, all metal.
7. Two biscuspid dummies, porcelain face.
8. Incisor dummy, porcelain face.
9. Bridge.

In the first item the student shows his knowledge of the correct tooth form, instruction having been given in a previous course, and it is in the nature of an examination.

In the metal crown we have the simplest and easiest crown that is made. Under this item will come the proper shaping of the root, cutting, soldering and adapting to the root of the band, shaping it to the proper contour; swaging and soldering the grinding surface. In doing this mouldine and fusible metal dies are used.

In the metal dummy we have in reapplication the same principles, with slight modification of detail because of the absence of the root.

The porcelain-faced crown is shown in its simplest form, and placed on the cuspid root. Here we have, in addition to the band, the dowel passing into the pulp canal, and the band itself cut away for the porcelain. In fitting the porcelain face, backing and fastening to the band, all the principles involved in crowns of this class are brought to the student's notice.

In the two bicuspid and the central incisor dummies the student has opportunity to reapply the principles just taught, with such slight modification of detail as will suffice to retain his interest and enthusiasm.

The banded Logan and removable porcelain-face crowns are introduced to give the student needed practice in some of the more delicate operations in crown making, the better to educate the brain and fingers to the requirements of his work.

In the bridge are assembled the two first crowns and all the dummies, the central incisor being held by a bar extending behind the lateral. These, when properly articulated to opposing teeth and securely soldered, it is believed, will furnish sufficient instruction in the principles and technic of bridge building, without the need of multiplying operations involving no new principles.

It will be seen that in this course the student has repeated experience in preparing the root, fitting and shaping the band, bedding, drying and heating the porcelain, and in the proper management of the flame to flow the solder to the desired place.

The course in orthodontia technics is as follows:

1. Making clamps for soldering.
2. Drawing wire.

3. Rolling band material.
4. Drawing and soldering tubing.
5. Making steel taps.
6. " 4 screw rods.
7. " 1 jack screw.
8. " 1 pull back.
9. " 1 traction screw.
10. " 4 loop retainers.
11. " Talbot-Coffin spring.
12. " Jackson crib.
13. " Angle retractor.
14. " 3 wrenches.

Usually it has been found useful to give some instruction in tying knots before beginning this course in technics. The difference between the square and the granny knot, the half-hitch and the surgeons' knot, has proved in actual practice sufficient for all needs. The student is often ignorant of these simple knots.

Of the solder clamps there are eight varieties. The most of them are reproductions or slight modifications of those figured in Guilford's Orthodontia. With some one of these eight clamps every variety of apparatus can be firmly held in place until fixed by the solder. They are made from large-sized hairpins. This material has proved of sufficient strength for the purpose. Piano wire can be used, but it is more difficult to form in the desired shapes, and offers no advantage over the cheaper and more easily obtained material. These clamps should be exactly formed in their curves, so as to hold firmly what is placed between their jaws.

Drawing Wire.—German silver is used in all our appliances. With the use of an ordinary drawplate, for the sake of uniformity we have adopted Joubert D. for the school. This furnishes holes of suitable size for our work, and insures the making of the appliances of each student the same size. This is held firmly in a vise attached to the student's bench. A piece of wire about seven inches long is given the student, from which he must make the two sizes most commonly used. The finished wire must be hard drawn, smooth and straight, and true to gauge. It should be smooth and straight, because in making jacks it must fit and yet work easily in the tubing; hard drawn, to hold a thread; true to gauge, that the thread may be perfectly cut and fit the nuts, without its being necessary to make a tap and nut for each separate jack.

Rolling the Band Material.—This may be done from either strips of plate or pieces of wire. The advantage of rolling from

wire lies in this, that however thin the strip the edge is always rounded, and therefore not so liable to irritate the gum tissues. Band material is used of different thicknesses. Thirty-six is the highest number on our gauges, but this is entirely too thick for many purposes. Bands should be hard rolled, smooth, straight and true to gauge.

Drawing Tubing—After the experience with wire and band material this will be found but little more difficult, for the student has already learned the necessity for a steady hand and straight, even draught in using the draw plate. A piece of metal one quarter of an inch wide and seven inches long is cut from the plate used in the prosthetic technic. This is the raw material out of which the tubes are to be made. As this is thicker than is desired, the first thing is to bring it to proper gauge between the rolls; and if the drawing is to be begun in the draw plate required for the student, it will be found helpful to curve the strip first with the plate benders; otherwise the largest hole in the plate will be found rather small, but if the strip is first evenly curved with the plate benders throughout its length, the drawing can be done in the one plate. When the edges have come into full contact the tube should be soldered with hard solder. This will be found no easy thing, for if the solder runs upon the inside of the tube the wire will not pass freely into it. If it runs much upon the outside, in filing it off it is liable to make the tubing of uneven thicknesses. The final drawing of the tube should be done after the soldering, and it should be drawn to fit accurately the wire which is to be used in it. These tubes are about eight inches long when finished, in our technic.

In making the rods, jacks, pullbacks, etc., each presents some new operation requiring care. In cutting the thread few succeed the first time, while drilling the nut, making and tempering the tap, and cutting the female thread in the burr present difficulties which call into play acquired dexterity and at the same time some new faculty. The bend in the pullback, holding and soldering the tube, and the screw upon the bands making a neat and workmanlike job, are not always easy to the student, and when accomplished, some added skill has been acquired also, which will be needed in the clinic during the senior year and in the office after graduation.

The Talbot-Coffin Spring gives the student his first experience with piano wire, and before it is finished satisfactorily he learns to handle it with much respect. No. — wire is used, and a piece long enough to allow of some waste is furnished. The coil is formed round an instrument held in the vise; the bends, with pliers.

The Jackson Crib is for a full lower denture, and is given for the same purpose as the above—instruction in manipulating piano wire. When the intractable steel has been formed to the will of the operator, much has been gained in the education of both fingers and brain, in handling tools and overcoming the resistance of metals.

By far the most difficult thing is the Retractor. The bands must be made with accuracy, the wire inside the lips must be hard drawn and unannealed, the small tubes and the ball must be soldered to it, without drawing the temper. The bar outside the mouth is made of hard drawn wire, No. 10, curved and bent by hand. The stud in which is drilled the socket for the ball must be soldered to it without drawing the temper, for it must retain its spring if it would serve the purpose for which it was designed. When these are successfully made, we believe the student can form for himself any appliance he may need in his practice. They call for educated fingers, nice manipulation and great care.

The three wrenches are not difficult, yet they present points of educative value; and the instruments are useful in after practice.

This technic work is carried on at the odd moments of the student's time, no particular time being set apart for it excepting for its beginning. This has worked very well with us, and in a course so crowded as ours necessarily must be seems to give the most satisfactory results. Could sufficient time be given in acquiring a knowledge of the profession to allow of ideally grading the course of study, the class could be put upon this work at some special time, and the instructor could give his sole attention to the technic work while it was in progress. At present, however, it has only been practicable to require that the technic work should be completed and passed before any practical work was given.

In closing, I wish one word of defence of so extended a course in orthodontia technics, holding to be true the words of our greatest writer upon this subject, that "manipulative skill is absolutely necessary even for the proper *adjustment* of the appliance" (Farrar's Preface, page 4), and also that there is no work which the dentist is called upon to perform equalling in dexterity, manipulative skill and fine workmanship this of devising, making and adjusting appliances for regulating. We think time so spent, no matter to what extent, is wisely spent by the student in acquiring this necessary training.

Metal Plate Technic.

GEO. H. WILSON, D .D. S.
Dental Dept. Western Reserve University.

It is difficult to separate one portion of plate technic work from the rest, and write of it by itself, because technic instruction implies a systematized course, including not only the principles involved but the modus operandi, or the what and how. This must be so arranged that each advanced piece of work will be easier to accomplish, because of the work that has preceded; also, as far as possible, suggest advanced steps to follow.

Nearly all students when they come to us are enamored with what is to them the beautiful crown and bridge work. We would not presume to commence our course with this difficult work, but we point out to the student that by starting with the easiest work, wax, plaster, vulcanite,—simpler forms of metal plate,—and then the more elaborate and difficult plate work, we are preparing the way for the successful performance of the most difficult productions of the laboratory.

We question the advisability of confining the class to one kind of work until all is accomplished that our limited time will permit, and then the next variety of work and follow that to completion, and so on; but we would intermingle the different kinds sufficiently to give variety and animation to the whole; yet we must keep the various kinds so grouped together that the silvery thread of thoughts which should pervade the entire course of instruction will not be lost by the student.

To illustrate:—At an early stage in the study of vulcanite we would introduce die and counter making, using a model that is easy to mould and aluminum as the metal to swage. This, with vulcanite attachment, will make the simplest kind of metal plate work, because the metal is so easy to work and requires no soldering. The student feels that he has made much progress, is encouraged and strengthened in his determination to succeed; consequently, we, as teachers, have accomplished much.

Soon after this I would introduce casting Watts metal, using rubber attachments. This will illustrate what I mean by so scattering a kind of work that the student loses the thread of thought. I would follow the casting of the first piece of Watts metal with all the instruction to be given in that metal, as it is a short course, say three pieces, or, at most, five pieces; but any other cast metal as aluminum, I would have at another period of the course.

When we have finished our vulcanite and celluloid technics, the student will not feel that he is to enter upon a new and untried field, because he has been introduced to die and counter making, and has swaged an aluminum base, and he thinks he is quite the master of the situation. In entering upon the strictly metal work, we should be careful not to choose too difficult a model. I like, at this time, to select a model of a partial upper, with the teeth true and well trimmed away,—one that is sure to draw readily from the sand, learning to give the right compression to the sand, (a knack that cannot be learned by word of mouth or seeing others, but must be acquired by experience,) in connection with fitting the plate about the teeth, is quite enough for one lesson. But we can add to this a lesson on the formation of doublers and give the first lesson in the use of the mouth blow-pipe, teaching the need of actual contact, that solder flows to the hottest place, independent of gravity, and has a strong affinity for capillary attraction (if you will permit the expression.) In this, we need only teach the use of the brush flame, quickly and evenly heating the work, and the kind of flame to use, so as not to oxidize the work.

The next piece of work I am quite partial to is the Cleveland vacuum base, choosing a large model and one that will draw easily from the sand. The ability to get the die and counter and swage the plate quite readily is very encouraging to the student and helps to compensate for the intricacies of construction of the remainder of the piece. This piece will give a good lesson upon shaping the wire to the edge of the central cavity, clamping and soldering without an excess of solder; also making a die and counter for and swaging a floor for the vacuum space.

Now, if we take for our next piece a partial lower, containing the eight anterior teeth only, that is symmetrical and will draw readily from the sand, we will have sufficient difficulty in swaging the piece in two sections, each from a heel to just beyond the last tooth on the opposite side, so that the portion of the plate back of the teeth will be double, soldering these together, and attaching clasps, will cause the student to proclaim it the most perplexing case he has yet had. He will master the case, because he has been brought gradually up to this difficult operation; but if, in place of this easy-to-mould partial lower, we had chosen a more difficult one, with undercuts, complicating the moulding and adding very much to the difficulties of swaging, the probabilities are that it would have quite discouraged him.

A very desirable piece of work to give the class at this time is a

full upper edentulous model, with heavy undercuts, and quite pointed at the mesial portion. I give preference to the core method of casting undercuts, and cause the plate to be swaged without slitting. This piece is to be wired for the complete outline of the vulcanite attachment; loops upon one side and pins upon the other for the retention of the rubber.

Thus far we have not complicated the work by attaching porcelain or requiring investments. The class has had considerable practice in the use of the mouth blowpipe, almost entirely confined to the brush flame. They have learned that oxygen is the foe of the solderer; that carbon is his friend, and should be kept in the ascendency in this kind of metallurgical work.

Our next lesson will embrace the two operations just spoken of, viz.: investments and attaching porcelain to metal. I do not believe it is time profitably spent to require the class to construct a full upper soldered denture of fourteen teeth. A partial of the four incisors, single gum teeth, well jointed and ground to fit the base, rimmed, and two clasps, will include all the principles involved, save an expense in teeth, and is far less liable to discourage the student.

To my mind, it would be the greatest folly to require the construction of the full upper or lower soldered piece after the completion of this partial, just to enforce the lessons of investing, grinding and attaching porcelain to a metal base, because these lessons will be not only enforced but re-enforced in the crown and bridge technics.

This obsolete denture would be very irksome to the student, and more than one member of the class, if there is that confidence and respect there should be between teacher and pupil, will say, "What is the use of spending our time upon this work that we will never do in practice, when there is so much that is demanded of our limited time that will be more profitable; it teaches no new principles, only elaborates."

The partial case *is* practical, and we will insert partial soldered gold dentures if we are not so rattled with bridge work that we, as operators, can *not* see the interest of our patient.

This amount of work I have found is as much as the average student can accomplish in six months' time, working fifteen hours per week. For the advanced students I have several difficult models to be reproduced in Babbitt's metal; as a partial lower with full length teeth, undercut in median portion, and a molar inclined inward and forward; also a full upper, very large, with nodular projections. In these, the student must study out for himself how to do the work. I give no instruction, but when he presents the results

of his work I commend the good points, and if there is any condition or method the student does not seem to comprehend, I call his his attention to it.

I regret very much that we have not a book especially adapted to prosthetic technics. Warren's Compend I consider the nearest to what is needed of anything we have.

When the work is forthcoming, I trust it will contain a chapter upon the flame, as especially adapted to the dental student. Our dental text books are almost silent upon the subject, so that the best chemistries give the only instruction of much account, and that as general information.

Proceedings of 1897 Meeting.

SARATOGA, N. Y., GRAND UNION HOTEL,
August 3rd, 1896. 10 A. M.

President Weeks in the Chair.

Minutes of previous meeting read. (Previously approved.)

The Treasurer's report was referred to the Executive Board to be audited. (Approved.)

Dr. Morgan, Chairman of the Executive Board, presented the printed program with appropriate remarks.

The Executive Board reported favorably upon the application for membership of the Northwestern College of Dental Surgery.

The ballot resulted favorably and the College became a member.

By motion, Dr. W. J. Brady was made Master of Exhibits during the present meeting.

The first paper announced on the program,—

Dental Pedagogics, by Dr. E. C. Kirk, was read.

Discussion opened by Dr. Brady, in writing. Further debate was participated in by Drs. Barrett, Trumen, Pierce, Weeks, Brophy, Smith, (B. Holly), Morgan, Gray, Essig, Molyneaux, Fillebrown, Patterson, Hunt, (A. O.), and Taft, with closing remarks by Dr. Kirk.

Adjourned till 8 p. m.

EVENING SESSION. August 3rd, 1896. 8 p. m.

The minutes of the morning session were read and approved.

The Executive Board presented a letter of resignation from the American College of Dental Surgery, said college having consolidated with the Northwestern University Dental School. Said resignation was accepted.

Dr. H. W. Morgan read a short paper on *General Technic Teaching*. Some interesting discussion followed.

By request, Dr. W. H. Richards, of Knoxville, Tenn., exhibited photographs of pulp chambers and root canal forms reproduced in gelatin without the investing tooth substance. Also, natural tooth forms reproduced in plaster-of-Paris.

By request, Dr. W. E. Harper presented his ideas of teaching root canal treatment.

By request, Dr. W. J. Brady illustrated on the blackboard the ease with which diagrams and drawings of teeth may be made both by teacher and pupil.

By request, Dr. E. A. Bogue presented a novel method for preserving the casts from which vulcanite dentures are to be made.

Owing to the absence of Dr. C. M. Bailey, Dr. Weeks presented, the course pursued by that gentleman in teaching Prosthetic Technics, exhibiting specimens of completed work made by students.

Discussion by Drs. Molyneaux and Guilford.

Adjourned to meet at 3:30 p. m., August 4th.

August 4th. 3:30 p. m.

Minutes of previous session read and approved.

Executive Board reported favorably upon the application for membership of the Marion Sims College of Medicine, Dental Department. The report of the ballot was favorable, and election resulted.

Dr. G. E. Hunt read a paper on *Porcelain Technics.*

Discussion by Drs. Jackson, H. A. Smith, Weeks, Dewey, Ambler, Guilford, Evans, Morrison and Templeton, Dr. Hunt closing.

The Association proceeded to the Election of Officers for the following year.

Result as follows:—

President, H. W. Morgan; Vice President, S. H. Guilford; Secretary and Treasurer, J. F. Stephan.

Executive Board:—G. H. Wilson, three years;*

Drs. Wilmot and Dewey conducted the newly elected President to the Chair, who was received by the retiring President with appropriate remarks and responded to suitably by the incoming President.

Dr. Cattell called the attention of the Association to Article 4, Section I, of the Constitution, and remarked, that he hoped as many Technic teachers, or superintendents of such instruction, would attend the meetings as possible. The *idea* of the Association was for their special benefit. If it were impossible for actual teachers to attend, then the College should be represented by other interested delegate.

Dr. Weeks suggested that it would be well to arrange the exhibits in the future in the Assembly Room to facilitate the illustration of papers as read. Hence, a room large enough for both audience and exhibits should be required.†

A motion prevailed that the time and place of the next meeting be left with the Executive Board to be hereinafter announced.

Minutes of present session read and approved.

Adjourned till called by the Executive Board.

J. F. Stephan,
Secretary and Treasurer.

*With D. M. Cattell, two years, and N. S. Hoff, one year.

†The Executive Board appointed Dr. W. J. Brady, Master of Exhibits for the next meeting, pending a resolution presented to create such an office permanently.

"The General Principles Involved in Technical Instruction in Dental Schools.—Dental Pedagogics."

BY E. C. KIRK, D. D. S.

University of Pennsylvania, Dental Department.

The field assigned to me in this symposium of views upon dental methods is one which I approach with much hesitation because of its complexity, and especially because of my sense of incompetency to adequately deal with it. I make the attempt, however, because of my intense interest in the subject and with the hope that I may be able to suggest some lines of thought which may lead to a discussion that will bring out ideas profitable to all of us.

The problem of dental education, as I apprehend it, is simply the problem of human education as adapted to the training of dentists; the adaptation of the general to the special. We are, therefore, concerned with a study of the principles and methods which are best suited for the education of the human faculties in general, and the application of these principles, with proper modifications, to the business of making dentists.

The educational process of making dentists is one which has undergone rapid evolutional change through the progressive development of our specialty and the increased educational equipment required by the dentist to enable him to adequately meet the demands upon his knowledge and skill as the field of his activities has enlarged.

It is not necessary to more than allude to the changes which in the past half century have taken place in what constitutes the science and art of dentistry; as these are familiar to all of us. We may, however, call attention to the fact that like all other departments of human knowledge, the origin of dentistry was characterized by its growth as an art and it was not until a vast mass of facts had been collated that their orderly arrangement into systems under generalizations based upon their common factors was attempted or was indeed possible. It was at the period when such generalizations in the form of so called natural laws began to be applied to the empirical facts and observations of dentistry, that workers in our calling began to be imbued with the scientific spirit and to adopt and apply the scientific method in their studies and as a consequence to educational methods. The adoption of the scientific method of research was not only an outgrowth of the expansion of the realms of dental knowledge, but a necessity in our educational methods for dealing with the enormous mass of data required in the mental equipment

of the dentist. The educational problem is not simply one of imparting to the student a knowledge of a certain group or groups of data, but there is involved the much more important consideration of how he should view these facts and phenomena, upon which question depends his whole mental attitude towards his professional equipment and his capacity as a practitioner; whether he shall be an empiric merely, or a rational, scientific dentist; whether in a given case his mental need will be satisfied with knowing how to do it or whether his higher cultivation as a scientific practitioner will lead him to demand the reason why he should do it and enable him, because of his superior training, to supply the necessary answer from intelligent reasoning.

The history of the growth of dentistry has its analogue and counterpart in the educational development of its individual practitioners. As dentistry has risen from the position of a mechanic art, practiced empirically, to a scientific profession, so have the individual members of the profession in the acquisition of their professional knowledge passed through the stage of fact-gathering, the observation of phenomena to the phase of orderly arrangement of and logical reasoning about their observations, thus developing the scientific method of thought as applied to their work. This sequence in the acquisition of knowledge is in no degree peculiar to dental education, but is the natural physiological order observed in all channels of human development. That it is so is a well-known and demonstrated fact which has been elaborately worked out by the modern school of psycho-physiologists. Much valuable information as to the natural or physiological processes of mental development has been derived from the systematic study of the intellectual growth of children. From carefully-conducted observations in this field of research it has been shown, among other things, that the child's knowledge of its environment is gained at first solely through the medium of its sense perceptions, *i. e.*, through sight, touch, hearing, taste and smell, and it is through these faculties that an unconscious automatism or reaction in relation to its environment is soonest established. The real education of the child proceeds through its sense perceptions almost exclusively for a considerable period of its growth, and it is only after development has progressed to a comparatively high degree that its education may be continued through appeals to its imagination, or that it has in fact any imaging power to appeal to. Let us consider for a moment what this power to imagine means. Literally, as I take it, it means the power to construct a mental image of something suggested to the mind through external

means. Suggestions, of course, originate from innumerable sources, but in systematic educational processes they are usually conveyed by the teacher to the pupil in the form of words to which definite meanings are attached, so that by a skillful assembling of words the teacher conveys to the mind of the pupil certain ideas which lead to the formation in his mind of an image of the thing suggested. If it be a material thing which is the subject of study, the suggestion of it is conveyed by a series of analogies,—its physical properties, for example, are stated as being hard, soft, green, yellow, tough, flexible, etc., and as each one of these attributes is named the pupil immediately relates it with some other object of which he has had experience, as a standard having these qualities, until when he has has thus related them all, by grouping them together he is able to evolve from the totality of separate images a composite of them, which depending upon the development of his visualizing power will be a more or less accurate mental image of the thing about which his teacher has been talking.

We have now seen that in his intellectual progress man develops in his mental capacity from a stage of mere observation and recording of simple facts related to material things in his environment, to the ability to deal with groups of facts and the relationship of these groups, in other words from the observation of concrete phenomena to abstract reasoning. We have also seen that with the difference in mental process is correlated a difference in the method of obtaining a mental grasp of the two phases of thought respectively. With these basal facts in mind we may profitably consider the character of the mental status of the average dental student at the beginning of his technical studies and the rational method of applying to his successful training the data already considered. Were the standards of preliminary educational requirements generally demanded by the colleges such as would admit as dental students only those trained in habits of study and those accustomed to logical abstract reasoning, the educational method required for their technical training would be much simplified. With the present preliminary requirements the colleges are flooded with men utterly untrained in the scientific method of thought and study, and as a consequence their successful education involves not only a training in the elements of professional knowledge, but a training in the methods of acquiring it. The whole field of dental knowledge is to the average dental matriculant a *terra incognita* to which, in many respects, he bears the same relation as the new-born infant does to his material environment. The problem of how to impart to him

the education which he demands is one which every consideration of equity, economy and honor demands should be seriously considered and intelligently solved. The matriculant by the act of matriculation becomes a party to a contract with the college, which, in consideration of the tuition fee demanded and accepted, agrees to supply the education and training necessary to equip the student for the practice of his profession. Considerations of economy and the spirit of progress that dominates our whole civilization demand that the method of education pursued shall give to the student the largest possible acquisition of knowledge and skill in the specified time of his course of instruction. In this respect the college has a duty to perform which economic and business considerations as well as the highest ethical requirements demand shall be faithfully fulfilled.

If it be admitted then that the relation of the dental matriculant to his new field of study is analagous to that of the infant to his material environment, it is evident that no more efficient method of imparting dental instruction to him can be devised than that patterned after the natural physiological method by which the infant acquires knowledge, viz.: through his sense perceptions. It is this method upon which is based the system of dental technical instruction which we are met together to study.

I have already indicated the main difference between the method of instruction by direct appeal to the perceptive faculties, *i. e.* the technical method, and the indirect method by appeal to the imagination, but it may not be amiss to call your attention to the relative efficiency of the two methods. The object to be attained in training the dental student with respect to a given procedure is first to give him a clear mental picture of what is to be done; second, how it is to be done and the ability to do it; third, why it is done.

If the thing to be done is the filling of a carious cavity in a tooth, for example, the teaching to him of what is to be done would be a very simple matter if the mere statement of the case, "The filling of the carious cavity" fully explained the whole procedure, which it does not. All that is contained in the statement, so far as information about the procedure is concerned, is a statement of the result. But we may go further and amplify the statement until we have developed it into a formal lecture, embodying a full description of all of the details of the operation, and though we may have furnished the student with a mental picture clear enough to enable him to essay the operation on his own account, with some hope of success, his concept of the procedure has been achieved in the form of

a mental image, the result of word suggestions through one perceptive faculty alone, viz., that of hearing.

In conveying a new concrete idea to an untrained mind it is necessary that the impressions be so vivid and definite that they remain indelibly stamped upon the memory, or, if you please, that the group of brain cells which have been stimulated by suggestion in such a manner that they function coördinately in the production of a given idea shall, when the suggestion is repeated, again function coördinately without break or fault in the process. In the example under consideration, and the whole series of mental phenomena to which it is related as a type, the permanence of the mental picture is directly due to the intensity and multiplicity of the nervous impressions which the brain has received concerning it. These impressions are more intense when the related stimuli are directly received than when indirectly received. Also their intensity is greater when the stimuli are received through several perceptive channels than through one. Hence instead of utilizing all of our energies in endeavoring to impress a mental picture upon the mind of the student through the medium of his auditory nerves we appeal also to his sight, touch and, if possible, his other sense perceptions, we have not only multiplied the intensity of our suggestion many times but have given him a direct mental stimulus instead of an indirect, resulting in a picture created by his own imagination. Where the mental image is the result of direct stimulus through the medium of the sense perceptions we say such knowledge is the result of actual experience and the relative superiority of that class of information admits of no argument. But we have seen that the major object of dental instruction is that the student shall be able to put into effective practice the knowledge which he has gained. He must be able to do the things which he has been taught to do. His education must therefore include an amount of skillful hand and muscle training, correlative with the degree of his mental culture. These two phases of his education must develop *pari passu* and in equivalent degree. The initial stimulus for the performance of an ideomotor act may be either central or peripheral in its origin. Where a sufficient knowledge of a given procedure has been gained through study of the subject to permit the coördinate action of the group of brain cells related to that procedure, the act may be attempted by reason of the central stimulus of auto-suggestion, but the command sent out by the brain to the group of muscles concerned in the act may fail of its object by reason of a lack of training in the muscles themselves. On the other hand, the muscles may be gradually

coördinate in the performance of some complicated procedure of which the brain as yet has developed no clear understanding and is consequently powerless to originate. Hence the act fails of perfect accomplishment from lack of coördination in the function of the central nervous control. It has been shown, however, that the repeated stimulation of the cerebral cortex by coördinated irritations of the peripheral sense perceptions, rapidly brings about a proper coördination between the central nervous control and the executive muscles, which means that complete understanding of the act performed by the muscles has been achieved and that the indefinite repetition of it now becomes possible whether originated as an ideomotor impulse in the brain or by peripheral stimulus of the musclo-nervous terminals. It is the combined training of the muscles and of the brain which has been shown by experience to produce the most rapid and satisfactory as well as the most permanent results. It is a mistaken view to regard the manual training or technic idea as a means merely for hard training. It is and should be regarded as a method of brain culture, with the hand as one of the means to that end, having the great advantage as related to dental education of creating a high degree of manual skill during the time that it is efficiently cultivating the brain.

The principle involved in the technic system of instruction is broader and includes more in its meaning than mere cultivation of the brain and hand. It should not be lost sight of that it includes the use of all the perceptive faculties as means of brain cultivation. With this idea developed for all that it contains not only may manual dexterity be achieved but all of the powers of observation be trained to their highest capacity, with a corresponding development of reasoning faculty in relation thereto.

In the teaching of the theoretical branches of dentistry the importance of the technic idea should not be lost sight of, as the applicability of it to these branches is fully as important as it is in the so called practical departments. The laboratory systems in chemistry, anatomy, physiology, pathology, bacteriology, etc., have on the continent of Europe, and to a large degree elsewhere, supplanted the didactic method of instruction, as they have been found to yield results in less time. There is great temptation in the didactic method to teach principles, before a knowledge of facts has been acquired.

This is unphysiological, wasteful of energy and comparatively a failure so far as the quality of the result is concerned. As an illustration of the comparative value of the two methods in the

theoretical branches, we may take chemistry as an example, and as a particular instance assume that the effect of pressure and temperature upon gaseous volume is a matter of instruction. By the didactic method with its corollary of text book study, the student was taught by the lecturer the law of Boyle, that the volume of any gas varies directly as the temperature and indirectly as the pressure. This he memorized and reasoned deductively from the law to the facts concerning it. The process, unless the student were previously trained in methods of abstract reasoning, was tedious and difficult because abnormal and unphysiological, and undoubtedly the exact reverse of the method by which the enunciator of the law arrived at it himself. If the student had first been made familiar by observation in the laboratory with the facts that gaseous volume is increased by temperature and decreased by pressure and had been told that these phenomena were uniform for all gasses, he would by the process of inductive reasoning have formulated the law for himself and by the same methods pursued by its discoverer. We should make the acquisition of knowledge a pleasure, not a labor, and the surest means to that end is the careful and intelligent elaboration of the principles involved in the technic idea of instruction and their application to all departments of our educational equipment.

Discussion opened by W. J. Brady, D. D. S., Western Dental College, Kansas City, Mo.

The acceptance of dental technics as part of our system of teaching marks an era in dental education. Technical teaching is in line with the times, and its usefulness and the variety of its application is only just beginning to be seen. The committee desired that this discussion deal with the practical side of dental technics—its every day teaching—and we therefore proceed to every day topics.

There are certain fundamental subjects to be considered in the successful teaching of technics. First is the teacher. The successful teacher is not a bird to be found in every bush. He must have a natural aptitude for teaching, and unlimited patience to explain the same thing over and over. He must have had experience in dental practice, and know when to expect failure and how to remedy it. Last, but not least, he must not be afraid of hard work—regular genuine work. Such a teacher will inspire enthusiasm in his class; for a real worker is always enthusiastic himself. Enthusiasm once obtained, the teacher must be careful not to lose it. It is easily lost by lack of prompt attendance by either teacher or student—idleness is fatal to it. The teacher should have his program well arranged,

and lose no time in beginning a new number when one is finished.

Besides a teacher of ability, there are other considerations. The teacher must be given sufficient time and suitable laboratories for his teaching. No teacher can succeed with his work placed secondary to everything else, nor in a crowded, ill-provided and poorly lighted room. Dental technics is of prime importance, and should come *first*, not second. In the arrangement of a course in technics, the teacher and faculty should have the most perfect understanding together. The technical teacher should teach just the methods the lecturer gives, and not substitute notions of his own. The lecturer should confer with the teacher, and profit by his experience in the class room, and the two agree upon methods that are feasible with the accommodations of the laboratory. If they do not have such an understanding, often the lecturer gives something that looks plain and easy, and in his office would be so, but in the class room is next to impossible of accomplishment. Lectures should be arranged to fit into the course in technics, and the technical work should be planned to bring fundamental work first and other work in its appropriate order.

The exact arrangement of a course in technics must vary in every school, as the general teaching varies in every college, and the technical work should follow the general teaching as far as possible, yet there are principles to be observed to succeed best. It is not so much a question of *how* to teach as *what* to teach and when to teach it. Each individual teacher has his own methods of teaching how to get a certain result, but what we want to know is what operations are best to teach, and when is the student best prepared to receive them. Education is but a process of unfolding, even as a plant unfolds first leaf, then bud, then blossom, and we must be careful to give the first thing first, not second nor third. The writer believes that prosthetic technics should be the first work to be taken up. At the student knows nothing of the dental organs or their makeup, and is not ready for anything that requires this knowledge. He is not prepared to begin filling teeth, nor even to study the anatomy of the teeth till their different parts have been explained to him and their function taught. He cannot appreciate a knowledge of their forms, for he has no practical application for that knowledge yet. Prosthetic dentistry requires the least previous knowledge of the dental organs to begin its study, and this is our argument for taking it up the first thing. Practice in this branch develops the untrained fingers and eyes, and as this work goes on the student is hearing lectures on other subjects in dentistry, and becoming prepared for

other technical work to follow. Another reason why prosthetic technics should be taught first. When the student once leaves this subject, he never can be brought back to it and work willingly. He has had a taste of something new, and prosthetic work becomes to him what many a dentist considers it, mere drudgery. Then is not the practice of beginning operative technics at the same time as prosthetic technics and alternating the two for one week or two weeks at a time open to improvement? Technics should not be mixed to get the best results. Better let the two teachers give their united time to prosthetic technics the first half of the term and then to operative technics the last half, rather than to alternate.

There is no time to give in this paper much of the detail of a complete course in prosthetic technics, but here are arranged upon these cards specimens of work representing a course in this branch which I know to be practicable from having carried several classes through it, and which may suggest something useful to my fellow teachers, although it is not offered as an ideal course. Impressions and models come first, then rubber plate work, then metal plate work. Added to this is part of a course in crown and bridge-work technics, which includes as its foundation considerable dental anatomy, and which will be considered later on.

A few practical suggestions at this point may not be amiss. The class should all have the same case at the same time. The teacher thus can do much better than if he had to give individual instruction upon a number of different cases at the same time. Set a time when each general case must be finished, and live right up to the rule. Students will quickly find that they cannot loaf or "soldier" on their work, and will finish each case practically together. Have some extras for the bright students who finish everything quickly, selecting something short and easily done, so as not to burden the teacher with too many different cases at the same time, and yet keep each student occupied. Remember that the secret of success in teaching is to keep everybody busy first, last and all the time. Let the motto be, "Either work or get out," and ruthlessly cast into outer darkness all idlers. On one point in prosthetic technics I wish to give an individual method, believing it to be ahead of anything else. All teachers appreciate that it is hard to get students to understand taking plaster impressions for plates, and especially hard to explain the mysteries of taking a bite, if the student makes his cases from models furnished by himself or teacher. To make these things plain a patient must be hired for the occasion, one who will submit to unlimited impressions and other such delicate atten-

tions. Keep this patient day after day until every student has secured a good impression, taken a bite, fitted a trial plate and made him a set of teeth, allowing the patient his choice from the lot. The rivalry to make the best set will keep interest up to fever heat, and the student will learn more on this his first case than for a dozen made up merely from models furnished by the teacher. Take plenty of time for this case and explain everything thoroughly—four weeks is not a bit too long for it. Let the students take fresh impressions and make new models just before investing and vulcanizing, or none of the plates will fit, due to the long time the models have been made. There is not time to enlarge upon other points in prosthetic technics; so with the arguments given for teaching this branch first, and the other suggestions and methods given, we pass to the subject of dental anatomy.

This branch is recognized as the starting point of operative technics and of correct crown and bridge work, and it is also recognized as hard to teach. I believe that the earlier methods of teaching it will be radically changed in time. I also believe that its teaching should be begun as early as possible for the student to appreciate it, but think that he should hear quite a number of lectures on dentistry before that time really arrives. The first thing in dental anatomy to be studied is the outward form of the teeth. It is a recognized principle of teaching that a knowledge of form may be best taught either by making drawings of the object or modeling it in some way. We can use both these plans in studying forms of the teeth. Here are some drawings of the teeth which are made on the same plan as map drawing; *i. e.*, first basal lines, then outlines, then details. These drawings are quickly made, and require very little knowledge of drawing beyond ability to draw a straight line with a ruler, and yet experience shows that they strongly impress a knowledge of tooth forms on the mind. Modeling a tooth to form is still better, and can be done in hard wood, wax, plaster or modeling clay. But better yet is modeling the teeth in bone, natural size, for the modeled teeth can be put to the most practical use in operative technics. Bone for this purpose may be secured from toothbrush handles, but better yet from the large packing houses, where it is cleaned and cut up for sale for handles, buttons, etc. Making drawings and modeling a tooth teaches its form much better than cutting sections and stamping silhouettes of the same, and is much easier done, from the fact that it is next to impossible to get enough teeth for silhouette work for a large class, whereas the other is easily found and supplied. Students also get

very tired of section cutting and printing, and it takes a great deal of time, most of which is spent in preparing the tooth to get a good printing surface, rather than actual examination of its form. I believe that section cutting should be carried on for examination of root canals, etc., only, and not for printing purposes. In this way all kinds of teeth can be used, whether badly decayed or not, and a sufficient supply obtained, and much time and labor be saved. After the student knows the forms of the teeth—not before—he is ready to begin both operative technics and crown and bridge work. In operative technics my idea of a course is to teach the preparation of cavities and filling the same, teaching the proper form of instrument for each part of the operation as the student requires its use, and giving the manipulation of each material as needed and used. I would also include the working of steel, and the manufacture of special instruments needed that could not be bought on the market. My ideal course would further include the treatment and filling of root canals, teaching the necessary instrumentation as required, and further study of natural teeth by the student, with much filing of teeth and examination of root canals both before and after filling. This course would finally include the preparation and insertion into extracted teeth of porcelain inlays, both baked and ground to form. The time for this course would be either in the latter half of the first year or the beginning of the second year—after the student knew enough dentistry to appreciate what he was trying to do. In studying preparation of cavities the student uses the bone models of teeth previously prepared, arranging them in form of the dental arch on a block of wood, and fastening them in place with sealing-wax. This block is fastened to another block with screws, and held fast to the table by clamps or screws, the original block with the teeth being in nearly the same position as teeth in the mouth are when in position for filling. Of course these bone teeth are not the same as natural teeth, yet they are quite hard and cut very similar to dentine, and do not cut or break to pieces as all extracted teeth do. Moreover, they permit the preparation of just exactly the cavity desired to teach, a thing which could not be found exactly as wanted in extracted teeth. Of course freshly extracted natural teeth would be the ideal thing for this course, but these are entirely out of the question to obtain, and it will be found that these bone teeth are the best substitutes yet devised. The teacher should have a large plaster model of each tooth, and prepare before the class the particular cavity the students are to copy, and then fill the same with enlarged instruments, using tin-foil in place of gold.

These enlarged instruments may be made of iron, wood or heavy copper wire. The student follows the teacher in preparation of the cavity, and finally fills it with gold, amalgam, cement, gutta-percha or tin, as directed. Non-cohesive gold work can be very satisfactorily taught by using No. 4 tin-foil in place of gold, and should be more thoroughly taught than it is. This is a very valuable method of filling teeth in cases that are suited to it, and it receives practically no attention at all. If these bone teeth are arranged in the arch with the space of heavy paper between them, they give the means of teaching proper contact or "knuckling" of fillings, and yet allow finishing of fillings as in the mouth. By placing the blocks supporting the teeth right, the use of the proper instrument for each place is almost compelled by the nature of things. Having derived so much satisfaction and profit from the use of these bone teeth at the Western Dental College during the past year, we feel pleasure in giving this method of teaching to our friends.

Not having time for further details in operative technics, a few observations on crown and bridge technics will end this paper. As before stated, a knowledge of dental anatomy is the foundation of correct crown and bridge work. It is not difficult to teach a student to flow solder, swage cusps, invest porcelain, or use a blowpipe, but it is hard to get him to shape crowns to a resemblance of teeth, or to know if a cusp is right or left, upper or lower, first, second or third. Previous study of dental anatomy will help make these things plain. Next to shaping crowns and dummies to natural form, the most important thing is to teach how to articulate crowns and bridges properly:—how to take bites, how to transfer a case from the mouth to the articulator and be able to make something that will fit when put back in the mouth. All cases made up from ordinary models, or simply assembled without any model at all fail in this important particular; in fact teach hardly half of bridgework. I take pleasure in presenting to you a plan whereby every portion of crown and bridge work may be taught exactly as in a practical case, except the actual preparation of roots and teeth in the mouth, which, of course, never can be taught in the technic room. Zinc or babbit metal models of a mouth permitting several cases of bridge work are soldered in an articulator, these models representing the teeth already prepared for bands or crowns, which are made and fitted to the zinc model, a bite taken and the case transferred to a regular articulator as in a practical case. The originals of these models were of course carefully carved to give just the bridges desired, and were arranged to drop from the sand by a little care so that many duplicates could

be made and every two students furnished with an articulated model. By various combinations being made, about ten or twelve pieces of bridge work may be made from these models, all different and all of the most practical nature. After making these, the student can make any combination of the things learned in these pieces of work when it comes to a practical case. The best material for making crowns and bridges in the technic room has always been a source of trouble to both student and teacher. Nothing else works just like gold. Copper is too soft and discolors so badly the student loses pride in his work. Brass oxidizes badly and is easily burned up. German silver solders well and does not contrast much from the solder used —silver solder—but is very harsh and stiff to work. The best substitute I have found for gold is five per cent. aluminum bronze, which is a beautiful gold color, is very hard to melt down, solders excellently, and holds its color well when finished, by making a solder composed of the bronze spelter and silver, a yellow solder is obtained, and by careful mixture and melting of the same, two grades may be produced which will correspond to 20k and 18k solders. This bronze works a little stiffer than gold, but is the best thing for technic work I have found up to date.

In conclusion, I would say that I believe dental technics is the best thing ever introduced in dental education, but we must not try to teach dentistry by technics alone. Nothing can ever take the place of lots of actual practice in preparing a student to practice dentistry as he should, but this practical work, together with a thorough technical course should make the graduate of the future a blessing to the people and an honor to his profession.

Outline of Course in Prosthetic Technique at University of Minnesota Dental College.

BY C. M. BAILEY, D. M. D.

First Year.—Steel Technic Course.

Draw the temper and straighten a hardened and bent steel rod seven inches long.

File a square taper on one end of this rod, the taper to be two and one-half inches long, small end No. 18 gage.

Smooth file finish and temper the handle blue, the taper light straw.

Make, and temper suitable for use in the clinic room—

Six Excavators:

Two Hatchets

Two Hoes (square, spoon).

Two Rapid (right, left).

Two Chisels.

Three Sudduth Enamel Scalers.

Two Wrenches.

One McGill Band Set.

One Ligature Hook.

One Tees' Knife, for porcelain-enamel work.

All instruments must be finished with file and emery. Handles drawn to blue and cutting points to the proper temper for use.

(This course is not necessarily finished during the first year.)

Dental-plate Technic Course.

[The Bonwill Articulator is used exclusively, and all sets, full and partial, are mounted in accordance with the laws discovered and enunciated by Dr. Bonwill, Am. Sys. Dentistry, p. 486.]

***Vulcanite Work.*—From a model of an edentulous upper jaw' the student takes an impression with modelling composition; pours the model; adapts his pattern plate; waxes; articulates with cast of lower natural teeth; arranges a full set of plain teeth to the proper occlusion; waxes the finished plate; flasks; packs, using pink rubber for labial portion; vulcanizes; finishes, as if for use in the mouth.**

From models of upper and lower edentulous jaws, full cases are made, following the same steps as above.

Practical drill in taking impressions with plaster, of upper and lower jaws. The models from these impressions to be mounted in wire articulators and left in the College Museum.

Construct a skeleton partial-plate, using gum-teeth, the steps of the work being the same as in the first case.

Repair a set of plain teeth, plate broken and with teeth loosened or broken.

Repair gum-section set, with plain tooth; with section.

Construct an upper set of gum-section teeth, ground to occlude with natural lowers as in second case.

***Metal Work.*—From a model of an edentulous lower jaw, take impression and make model for cast metallic base. Adapt the pattern-plate, carefully observing the plate-line. Rim the plate all around, mould the matrix and fill with tin; finish as for the mouth.**

From a model of an edentulous upper jaw, obtain a model and shape suitably for moulding. Mould, and pour male and counter dies. Make the pattern, cut and swage the plate. Finish.

Repeat the above, using a lower model.

Swage a skeleton partial upper, following the steps as above. Strengthen the plate; adjust clasps; occlude teeth to natural lowers; solder teeth to plate. Finish as for the mouth.

Swage lower partial, strengthen and finish, as above (without teeth).

Upper full and partial lower sets, with plain teeth, plates swaged and rimmed, lower plate with clasps.

Upper and lower full sets gum-section teeth, occluded with each other; upper swaged, fully rimmed and with Cleveland chamber; lower of cast metal. (The metal may be cast to the teeth or the teeth attached with rubber, as the instructor shall decide.)

Second Year.—Crown and Bridge Technics.

The technic course is supplemented by a series of descriptive lectures and demonstrations, by clinics and infirmary practice.

Practical Course.—Carve out of hard wood, from memory—

One Molar Crown.

One Bicuspid Crown.

Prepare root of molar tooth for band; prepare root of bicuspid tooth for band and dowel pin; prepare root of cuspid tooth for band and dowel pin.

Select upper first molar tooth; select upper cuspid tooth for same side.

Make impression of upper jaw containing all the natural teeth. Place in position in the impression, in their respective places, the selected teeth. Pour model and when dry separate.

Make impression of lower jaw of same mouth, containing all or nearly all the natural teeth. Pour model; when dry separate.

Place upper and lower models in their proper relation to each other and mount in plaster articulator.

Carve out of the upper model the second molar and the two bicuspid teeth between the natural teeth and the central incisor of the same side.

Cut off crown of natural molar on model; prepare the root to receive a band; measure the root with wire.

Make a molar shell crown, carving the cusps in hard wax to articulate with lower teeth. Make Mellotte die and counter to swage cap.

Fill molar cusps; solder to bands; finish and place in position on root.

Prepare cuspid root for Richmond crown, enlarging the canal for dowel pin.

Make Richmond crown. Finish and place in position on root.

Make metal shell dummy for second molar.

Make porcelain-faced dummy for second bicuspid tooth, using solid cap and making bevel joint between cap and porcelain.

Make porcelain-faced dummy for first bicuspid tooth, using hollow cap swaged in die plate.

Make porcelain-faced dummy for central incisor, having metallic protection on incisive edge; metal to be so distributed as to be invisible from labial aspect.

Make extension bar from cuspid crown to carry the central incisor.

Assemble, join with hard wax, remove from model, invest, solder finish and replace on model.

In addition to the above, the student will be required to select a natural central incisor, prepare the root for a Logan crown, grind and adapt the crown, using a band or collar. Select also a bicuspid tooth and prepare it for a porcelain-faced shell crown. Make a crown with a removable porcelain face and adapt it to the root.

For Logan crowns use old-fashioned pivot teeth with metal dowel pin cemented into depression on the top.

The metals used in this course are brass, German silver, phosphor bronze and silver solder of two grades.

Orthodontia Technic Course.

Tying knots.
Making clamps—eight varieties.
Drawing wire.
Drawing tubing.
Soldering tubing.
Rolling band material.
Make one jack screw.
One pull back.
Four screw rods (this includes making the tap).
One Talbot spring.
One screw loop retainer.
One Jackson crib.
One retractor for protruding teeth.

Third Year.—Crown and Bridge Technics.

Select upper incisor tooth. Prepare for porcelain-faced jacket crown, not interfering with the pulp.

Make jacket crown of gold, soldering to it the porcelain face.

Make jacket crown of platinum, attaching the porcelain face by fusing in the furnace.

Make porcelain bridge of not less than one shell crown, one dummy tooth and one porcelain crown.

Make artificial porcelain gum on dummy tooth.

End of bar to be soldered to shell crown.

Oral Surgery Technic Course.

One hinged obturator and vellum of Aluminum.
One obturator, soft-rubber vellum.
One obturator, hollow-rubber vellum.
One set Sudduth's mento-dental splints.
One interdental splint.
One set Angle clamps.

Plate Technic Course.

One full upper set, platinum plate, reinforced, rimmed, and fully enameled, teeth ground to occlude with natural lowers.

One full upper continuous-gum set, teeth ground to occlude with natural lowers, mounted on aluminum.

One upper cast-aluminum plate.

Porcelain Technic.

BY GEORGE EDWIN HUNT, D. D.S.,

Indiana Dental College.

In the past the practical teaching of porcelain work in our colleges has been more or less neglected, owing to the cost of the material used in its construction. The prices of platinum, pure gold and tooth body are, and always will be, such that no college can afford to allow its students much latitude in their use in the technic laboratory. A few of the students in some of the colleges gain a practical knowledge of platino-porcelain crown work in the Infirmary. and a very limited number may be fortunate enough to get a continuous gum denture to construct during their college career. But the class of people from which our clinics are derived can seldom afford to pay the bare cost of the material used in a continuous gum denture, and the great majority of young dentists are compelled to

either attend a post-graduate course to perfect themselves in this work, or to buy a furnace and obtain their knowledge by experimentation. The difficulties thus placed in the way of securing practical information concerning this branch of prosthesis deter many of the young men from attempting it, so that the use of continuous gum dentures, the most artistic and satisfactory substitutes for the lost organs that can be made from the hands of the dentist, is largely confined to a few progressive men in our larger cities.

In an endeavor to reduce the item of expense, the Indiana Dental College began experimenting with low fusing enamels, such as are employed by jewelers. As a result of many trials, a white enamel known as "White Enamel No. 20," imported by F. Gesswein, No. 39 John street, New York, was decided upon as being the best adapted to the purpose. This enamel is one that will fuse on silver solder. It costs $4.80 per pound. A pound economically used would probably serve to finish 25 upper continuous gum dentures; but in the hands of inexperienced students it will scarcely answer for 15 such.

The enamel comes in vitreous, irregular-shaped cakes about three and three-fourths of an inch thick. Mr. Gesswein informed us on inquiry that he had no facilities for grinding it. That was a serious drawback, but the firm of Eli Lilly & Co., manufacturing chemists, kindly reduced it to a crystalline form for us. Experimentation, however, showed that in this form, about like granulated sugar, it was still unfit for use, and it was further reduced to a powder by the aid of a mortar and pestle, before the college course was attempted.

Our method of teaching during the past year was as follows: The class was divided into sections of ten. Each section was taken first through a course of crown-work, which course was completed by that section before the next section began. Impressions were taken of each other's mouths, and the plaster models made from these were articulated. It was required that each student construct at least two crowns, an upper bicuspid and an upper incisor. The selected teeth on the articulated model were trimmed to the desired shape, and 28 guage brass collars, lapped and soldered with silver solder, were fitted to them. This work was all done before the section was assembled, as their previous knowledge of crown and bridge-work sufficed up to this point. They were then instructed in bracing the band by means of a counter sunk floor of brass; in shaping the labial aspect of it to accommodate the porcelain face, and in soldering on a post for use in the canals of pulpless teeth.

Each student then ground his facings, using cuspid plate teeth with horizontal pins for the bicuspids and the proper plate teeth with similar pins for the incisors. When this had been satisfactorily accomplished, the facing was adjusted *in situ*, the band and facing invested and the pins in the facing soldered to the band and to the post, if one was used. The bands were then laid aside and the section instructed in burning batches of enamel on a piece of brass plate, using both the gas and electric furnaces. This was continued until every member of the section had successfully baked some enamel, and had gained a fairly accurate knowledge of the amount of heat required to accomplish this result. The tendency, of course, with such a low fusing body, was to overburn, but after a few trials, their eyes were educated to recognize the appearance of the baked enamel. Instructions were then given in backing up the crowns with the body, shaping, drying and running through the furnace two or more times, as was necessary to acquire the desired form.

After completing this work, and while other sections were receiving similar instructions, each student swedged a brass plate and doubler and soldered a half-round brass wire on the rim. They then set up the teeth, invested plate and teeth, and soldered. The teeth were bought at wholesale by the college and sold the students below cost. Finally the body was added and the case baked until a satifactory result was attained.

I am well aware that this work as outlined presents some seriously objectionable features, and I do not contend that it is as yet entirely satisfactory. The extremely low fusing point of the enamel is a drawback, and the student will require some practice with tooth bodies before he can attain the best results, but that is the case with any of us when we change from the use of one make of body to that of another make. Again, the enamel is brittle and friable, and on account of the rapid oxidation of the brass in the flame it does not adhere to the plate or collar as well as could be desired. Then, selection of color or shade in the backing of the crowns is impossible, and the final finishing of the plate with gum color has not yet been successfully accomplished. In this latter connection, experiments were made with the colors used in porcelain art work, some of which fuse at a very low heat, but their practical utility in the course was believed to be so slight that the experiments were dropped before any definite conclusion was reached. The course is, as I say, crude. Further experiments should be made with copper or German silver in place of brass; and perhaps a more suitable enamel than the one mentioned may be discovered.

But, admitting all these defects, we are still of the opinion that such a course as has been here detailed is calculated to give the student a deeper insight into this branch of dental prosthesis than previous methods of teaching have afforded.

Report of Board of Directors.

BY HENRY W. MORGAN, M. D., D. D. S.

Gentlemen of the National School of Dental Technics:—

My colleagues have imposed upon me the duty of outlining to you the work as mapped out by them for this meeting.

As this association is intended for the improvement and development of technic teaching, it is desirable to avoid as much as possible, repetitions and all discussions which would tend to crowd the work or hinder its progress along definite given lines.

At the meeting of the Executive Board in January it was determined that for this meeting, we would consider the subject of Pedagogics, Prosthetic and Porcelain Technic, and invite an exhibition to be introduced by this symposium to be made up of, as far as practical, of at least one supplement of the various kinds of work required by as many schools as would feel inclined to take part in the display. So much of dental teaching is now covered by the technic courses, that we were led to believe that the better policy would be to confine ourselves within these narrow bounds, and invite from those present, such discussion as would tend to develop the stronger points in them, and show up what was weak and of little value.

Our aim and object being to so perfect the work that it may be rendered more efficient, more inviting to the student, and at the same time, make it of eminently practical value to him while in college and after graduation. This display with the symposium is intended to set forth the work required by the schools that we may at a glance get a clear and comprehensive idea of what is being required without consuming the time of the association in unnecessary detail.

While we invite a free and full discussion of the papers, we wish to emphasize the fact that it is the hope of the board that members will confine themselves strictly to the topics under discussion, as we have already mapped out and planned the work for the next year, and believe that in this way we can do more for the encouragement of technic teaching by thoroughly developing one subject before passing to another.

The rapid advancement made in this way and the fact that it is growing in favor and popularity with the students, and the amount of interest which has been manifested in it by teachers everywhere, lead us to hope that the meeting of this association will annually grow in interest, and we specially desire to emphasize the fact that the time we spend in it must be devoted entirely to the consideration of some branch of dental technic, and members are specially requested to remember the fact that all questions of legislation will be simply read and referred to the Board of Directors. I have now the pleasure of inviting your attention to a number of exhibits placed here by the schools.*

Report of Prosthetic Technic Work of the Colleges of the National School of Dental Technic Teachers,

Fourteen colleges reporting, as follows:

Royal College of Dental Surgeons, Ontario.
Harvard University Dental Department.
University of Michigan Dental Department.
Louisville College of Dentistry.
University of California Dental Department.
University of Minnesota College of Dentistry.
Western Dental College.
Western Reserve University Dental Department.
Northwestern University Dental School.
Indiana Dental College.
Pennsylvania College of Dental Surgery.
Vanderbilt University Dental Department.
University of Buffalo Dental Department.
Philadelphia Dental College.

DENTAL PLATE TECHNICS.

Question No. 1—Have you a course in this department? If so, state how many hours per week, how many weeks and at what time of day this work is taught.

All report having a course in Plate Technics.

Hours per week from four to eighteen; mostly twelve to eighteen hours.

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* The exhibit was very complete and elicited much commendation from all present. The heroic models of the Dental Department of Harvard University, exhibited by Dr. Thos. Fillebrown, attracted particular attention, as did the exhibit of Prosthetic Technic from the Dental Department of the University of Michigan, chiefly because of its sequential arrangement, which made it tell at a glance the story of how this branch of the work is taught in that school.

Number of weeks, eight to thirty-two—one forty-eight weeks (two years of six months).

One reports 800 hours each year.

No uniformity in time of day, but about equal between morning and afternoon; some both morning and afternoon.

IMPRESSIONS.

Question No. 2—What materials do you use and what time devoted to each?

Question No. 3—What impressions do you require in plaster?

Quite uniform. Wax, Compound and Plaster—although some do not use wax. The time, when stated, is about one week to each.

In most of the schools it is apparent that each student has a colleague for a patient and secures a full upper and lower impression and model, in each of the materials used, that are satisfactory to the demonstrator.

One school reports no uniform requirement, but governed by the cases presenting.

One school with over a hundred students states they hire a patient, with edentulous jaws. by the day, and each student secures a perfect upper and lower impression.

PLATE WORK.

Questiou No. 4—What pieces do you require in vulcanite?

One school reports—All that presents in daily practice; one, four pieces, three repairs and one regulating; another, four pieces; two others, four pieces and repairs; one, three pieces; one, six pieces; one, seven pieces and four repairs; one, six pieces and one repair; one, two pieces and two repairs; one, seven pieces and two repairs; and one reports one specimen piece, the rest practical; average about twelve cases a year; two not stated.

Question No. 5—What in cast metal, and what metal or alloy used?

Four schools report no cast metal.

Six report one piece each—two of these use Watt's metal. One uses Weston's, one Watt's or Weston's, one Kingsley's formula (Su. and Bi.).

One school casts two plates, lower; uses Watt's metal.

One school a full lower metal plate and a second piece; metal cast to teeth with pink gum facing. Uses tin.

One school casts a lower plate, using either tin, soft solder or sterotype metal.

Another school casts a full lower with rubber attachment, a partial lower base with wire stiffener, and a partial lower cast to teeth with wire stiffener. Kingsley's formula metal used.

One school casts full upper cases of Carroll's aluminum and Reese's method, also full lower cases Watt's and Weston's metal.

Question No. 6—What do you require in swaged work?

No. 1 school reports: Required a brass plate rimmed, with single gum teeth, depositing plate.

No. 2—Refers to schedule, which was not sent.

No. 3—One aluminum plate.

No. 4—(*a*) Full upper plate, Cleveland vacuum chamber and wire rim; (*b*) Partial upper with Cleveland vacuum chamber, not less than four teeth mounted; (*c*) Partial lower with clasps; (*d*) Difficult partial upper plate, very high arch.

No. 5—(*a*) Swage skeleton or crescent plate for partial upper, teeth backed and soldered; (*b*) Full upper blank with turned rim, plain teeth, vulcanite attachment, pink gum facing; (*c*) Full upper, teeth backed and soldered, soldered rim and doubler; (*d*) Swaged aluminum; (*e*) Three methods of attaching with vulcanite.

No. 6—(*a*) Partial upper with two or more teeth soldered; (*b*) Full upper with teeth attached with rubber.

No. 7—(*a*) Upper aluminium; (*b*) Chase upper; (*c*) Partial doubled cases (blank); (*d*) Cleveland vacuum cavity (blank); (*e*) Partial lower clasps (blank); (*f*) Full upper wired (blank); (*g*) Four incisors backed soldered, rimmed and two clasps.

No. 8—(*a*) Full upper and lower aluminium, gum section teeth; (*b*) Chase plate; (*c*) Full upper, brass wired (blank); (*d*) Full upper, brass turned edges, double thickness over palatal surface.

No. 9—(*a*) Upper partial skeleton, reinforced, two clasps, teeth soldered; (*b*) Full upper rimmed, plain teeth, attached by vulcanite to staples; (*c*) Partial under plate, doubled back of teeth, clasps; use German silver for these plates.

No. 10—(*a*) Lower metal plate in two sections, soldered. (*b*) Cleveland vacuum cavity base. (*c*) Twenty-eight teeth ground and attached on metal base. (*d*) Partial upper four incisors, soldered. (*e*) Metal base, two standard clasps. (*f*) Full upper metal base, with wire boundary for vulcanite attachment.

No. 11—Full uppers, lowers and partials.

No. 12—One aluminium, three brass and one silver.

No. 13—Specimen work, full metal. Superior par. metal, five teeth or more. Inferior par. metal. Also practical work.

No. 14—Full lower, vulcanite attachment. Full upper single gum teeth, soldered.

Question No. 7—What, if any, in continuous gum?

Nine schools report not required.

One school a partial case; one a lower case.

One school, cabinet cases.

One schoel a full upper set to articulate to natural lower. The lower their own or a fellow student's.

One school reports swage brass base, solder rim and doubler, teeth articulated and attached, reinforced with clay. Porcelain body placed in position and carved same as for baking, represent sugar festoons, etc. One case from start to finish made before class as clinic.

Question No. 9—Do you require technic work in obturator and velum, interdental splint or Angle clamps? If so, state what?

Eleven schools report not required.

One school, one Suerser obturator, one Kingsley velum, one interdental splint.

One school, interdental splint, clinical instruction in obturator and velum.

One school, obturator and velum and interdental splints.

As this last is reported by the same school having about twelve practical vulcanite cases to each student per year, I take it the obturator velum and interdental splints are practical cases.

Question No. 10—Have you any other technic work not covered in above? If so, what?

One school reports—(*a*) Electro deposit of full upper plate in copper and silver. (*b*) Electro plating with gold and nickel. (*c*) Carving and baking of porcelain teeth, single and in blocks.

Another school reports—"Different methods of obtaining bites."

Another school reports—Celluloid.

(The subject of celluloid was entirely overlooked by the Executive Board in formulating the list of questions. It is to be hoped that with experience the Board may do better in the future; and that the colleges may be most concise in their answers, and also confine themselves to the technic departments, and not interweave the clinical and lecture departments.)

Question No. 11—What text-books used?

Richardson, Harris, Essig, Wildman's Instruction in Vulcanite, Black's Dental Anat., American System of Dentistry, Litch, Warren's Compend, Evans, Kingsley's Oral Deformaties, are the authorities given in answer to this question.

A need for a standard text-book for prosthetic technics.

METALLURGY.

Questions 7, 12, 13.—(a) Have you a course in this department? (b) If so, please outline. What text-books used? How many hours required, and when do you introduce the work?

Several report yes, and state that it is a lecture course; but this is not technic. All probably have the lecture course. A short outline is here given of the course at the University of California; but a full report is in the hands of Dr. Stephan for the inspection of any who may desire to examine it.

Report.—Laboratory work, with Zn, Sn, Pb, Al, Ag, Au, Cu, Hg, etc. Alloying and refining, making plate, solders, amalgams, blowpipe tests for metals, etc., etc. Essig for text book. (*c*) Two hours each week throughout senior year.

Questions 14, 15, 16.—Have you a steel technic course? If so, state number and name of instruments constructed. State number of hours employed in this work.

Five schools report courses as follows:

No. 1—One dozen excavators.
One-half dozen pluggers.
Two dozen chisels.
Two dozen scalers.

No. 2—Set of soft gold pluggers.
Nerve instruments.
Contouring pliers.
Various individual instruments.

No. 3—Annealing and straighening a round steel rod. Tapering one end four square with file. Tempering and polishing, handle blue, point of taper light straw:

Two right-angle hatchet excavators.
One hoe excavator.
One spoon.
Right and left saped.

No. 4.—Excavators, chisels and recutting burs.

No. 5—Nerve broches, chisels, excavators, plastic fillers, two gold plugger serated, tempering, etc.

One school states time for this technic as three weeks. The time preferred for this work seems to be in the junior year.

Question No. 17—Have you a technic course in crown and bridge work?

All report yes.

Question No. 18—State what preparatory work, if any, you require.

Five colleges, no statements given.

Three colleges require completed plate technic.

One college requires tooth forms, knowledge of dies, counters, dies, swaging and soldering.

One college, exercise in cutting band in proper shape and casting cusps.

One college, anatomy of outward forms of teeth, drawings and actual teeth.

One college, carving wholly from memory in hard wood, one molar and one bicuspid crown.

One college, preparing abutments on plaster casts.

Question No. 19—State number and name of shell crowns.

One college reports two molar crowns.

One college reports two crowns.

One college reports three for deposit, any number for practice.

One college reports three upper bicuspid and molar and lower molar.

Two colleges report four, one each upper and lower, bicuspid and molar.

One college reports four, two Richmond, two seamless or stamped.

One college reports five crowns—two bicuspids, one molar and two incisors.

One college reports six crowns, molar and bicuspid.

Three colleges, no report.

One college reports 150 all kinds; also, under the next two questions, 200 Downie and Richmond, and 180 bridges.

Apparently another instance of practical work reported as technic work.

Technic work is done upon models or extracted teeth, and is, or should be, done prior to any *practical* work in the same line.

Question No. 20—Number and name of porcelain-faced crowns.

Three schools make no report.

No. 1—Six for deposit, many for practice.

No. 2—Two—one each Richmond incisor and bicuspid.

No. 3—(*a*) Bicuspid shell crown with porcelain facing. (*b*) Solid bicuspid and molar crowns with root band and retaining pins, with and without porcelain facing. (*c*) "Saddle-back" teeth, mounted on caps for molars and bicuspids. (*d*) Telescope crowns for removable bridge attachments to molars and bicuspids. (*e*) Richmond removable bridge attachment for cuspids and incisors. (*f*) Cuspid and incisor crowns without band, retaining pin and porcelain facing. (*g*) Half-band crown with retaining pin and porcelain facing, extending under gum in front, for cuspids and incisors.

No. 4—Richmond, Commonsense, Downie, platino-porcelain, Box, Howe, Parmly-Brown, Logan.

No. 5—Two Richmond (cuspid and incisor).
One bicuspid, the porcelain unprotected.
One molar, the porcelain protected.

No. 6—Four crowns; one each Richmond incisor and bicuspid; and one each Case incisor and bicuspid.

No. 7—Introduce these in bridge cases 28 and 33, Ruds.

No. 8—One Richmond, cuspid; one Logan, banded.
One metal shell removable face.
One bicuspid dummy, solid swaged metal cap.
One bicuspid dummy hollow swaged metal cap.
One incisor dummy.

No. 9—Two centrals and one bicuspid.

No. 10—Darby—modified darby—Richmond—Case tube crown.

No. 11—Two.

Question No. 21.—Number and describe bridges constructed.

Three schools not represented.

No. 1—One bridge extending from first molar to the lateral incisor. The first molar, shell crown. The cuspid is banded, has a retaining pin and porcelain facing. The lateral is soldered to the gum of the interspace. The bicuspid dummies solid, porcelain faced and rest upon the gum only in front.

No. 2—All gold swaged, all gold cast, porcelain-faced box, porcelain-faced soldered, gold cusps cast and swaged, bar anchorage, crown anchorage, combination anchorage, slipper and shell anchorage, Downie method, Richmond method.

No. 3—Three bridges of not less than three dummies. Two

of the three to extend from bicuspids to molars, the dummies of one consists of metal entirely, the other of porcelain faces tipped.

No. 4—(*a*) Half cap, full bicuspid; first bicuspid dummy and lug upon cuspid. (*b*) Half cap cuspid, two bicuspids, dummies porcelain-faced tipped, shell crown on molar. (*c*) Shell crown molar, two bicuspid dummies, porcelain-faced Richmond crown for cuspid, four incisor dummies, half cap for cuspid.

No. 5—(*a*) One all metal bridge, four teeth lower; (*b*) One porcelain, six teeth, upper incisors and cuspids; (*c*) One pier bridge, bicuspid or central; (*d*) One removable bridge, lower.

No. 6—One bridge with extention bar, in which are assembled all the crowns and dummies in the crown course, to-wit: One incisor, two bicuspids and one molar dummy, with molar shell, Richmond cuspid, and extension bar.

No. 7—One bridge of at least three crowns for deposit.

No. 8—(*a*) One superior anterior bridge of not less than four teeth; (*b*) One inferior posterior bridge of not less than four teeth, one dummy porcelain tooth and one all metal.

No. 9—(*a*) One bridge (not less than six teeth); (*b*) Removable bridge (not less than four teeth).

No. 10—Four bridges.. { Removable,
Cemented lower molar,
Lower incisors,
Crib for upper bicuspid, and lateral incisor.

No. 11—Three bridges—(*a*) Four teeth with two shell abutments, and metal faces on grinding surfaces; (*b*) Four teeth, one shell and one band abutment, porcelain grinding surfaces; (*c*) Four teeth, two Richmond banded crown abutments.

Question Nos. 22, 23—Do you require any work in platinum and enamel crown and bridge work? If so, describe pieces.

Five schools report requirements under this head:

No. 1—Downie crown.

No. 2—Four incisors and two cuspids attached to cuspid roots

No. 3—Downie crowns.

No. 4 –Porcelain inlays.

No. 5—Downie crowns, one or more.

Questions Nos. 24, 25, 26—State hours required for this work? At what time in the course is this work done? What text-books used?

One school allows four hours a week for twenty-four weeks; another twelve and a half per week for sixteen weeks; another fif-

teen hours per week for ten weeks; another fifteen hours per week for four weeks; one four months; one six months.

One school teaches this work in the first year.

One school teaches this work in the third year.

The others, as far as reported teach it in the second year.

ORTHODONTIA TECHNICS.

Questions Nos. 27, 28—Have you a course in this department? State number and name of pieces required in preliminary work?

Seven schools teach this department only in the clinical or practical department.

No. 1—Each student makes one piece, either Jackson or Angle system, and one rubber piece, from different models.

No. 2—(*a*) Draw wire. (*b*) Rolling plate. (*c*) Making tubing. (*d*) Tap and drill. (*e*) Screw and nuts. (*f*) Square tubing for nuts. (*g*) Magill bands. (*h*) Magill bands and tube. (*i*) Magill band and hook. (*j*) Matteson cap. (*k*) Angle's jack-screw. (*l*) Angle drag screws. (*m*) Angle clamp band. (*n*) Retention appliance. (*o*) Angle appliance for double rotation. (*p*) Goddard's appliance for expansion. (*q*) Labial bow and nuts. (*r*) Vulcanite plate and labial bow. (*s*) Coffin split plate. (*t*) Jackson crib.

No. 3—Regulating appliance, use of draw and screw plate.

No. 4—(*a*) Rolling bands. (*b*) Drawing wire. (*c*) Cutting threads. (*d*) Making nuts. (*e*) Jack and traction screws. Assembling these into one appliance. A second piece consisting of a Jackson crib.

No. 5—(*a*) Tying knots. (*b*) Making clamps (eight varieties). (*c*) Drawing wire (two sizes, German silver). (*d*) Drawing tubing (two sizes, German silver). (*e*) Solder tubing in eight-inch lengths. (*f*) Roll band material (German silver). (*g*) Steel taps, two sizes. (*h*) One jack-screw (Angle). (*i*) One pull-back (Angle). (*j*) Four screw rods. (*k*) Four loop retainers. (*l*) Traction screw. (*m*) Talbot spring. (*n*) One Jackson crib. (*o*) One Angle retractor. (*p*) Three wrenches.

No. 6—Draw plain wire hard and annealed, draw heavy hollow wire, draw hollow wire from 32 gage plate solder joint, then draw down so that solid wire will just pass through. Draw very heavy hollow wire through square plate, solder joint and then drawing till quite hard, to be used for nuts. Making three sizes of steel taps and tempering them. Make three German silver nuts (from the

square wire) of each size taps. Cut three bolts from the solid wire one inch long, of the three sizes.

No. 7—Two coffin plates.

Four Case, Angle and Harvey.

Two Jackson.

Question No. 29.—Describe the appliances required as assembled from the preliminary work.

Answers as far as given included in the above.

Question No. 30.—State hours required for this work, and when introduced?

Time occupied by this work ranges from twenty to forty hours. One school teaches it in the first year, two in the senior year and the others in the second year.

Regretting very much my inability to be present in person, I assure you I am present in spirit.

I trust that next year the report of this committee may be much fuller, and that the various colleges may aid in this by sending in their reports early. Two of the reports were received as late as July 29th, and others only a few days before.

The nature of the report is such that all should be in before beginning compilation. We waited till the last moment, hence the lateness of this summary.

Most respectfully,

Geo. H. Wilson, *Sec'y of Board.*

Report of Work Done by the Schools Belonging to the National School of Dental Technics.

Schools reporting, eighteen.

Northwestern University Dental School.

Chicago College of Dental Surgery.

Indiana Dental College.

Philadelphia Dental College.

Kansas City Dental College.

Royal College of Dental Surgery of Ontario.

Pennsylvania College of Dental Surgery.

Vanderbilt University, Dental Department.

University of Minnesota College of Dentistry.

Western Dental College.

Western Reserve University, Dental Department.

Ohio College of Dental Surgery.

University of Buffalo, Dental Department.
American College of Dental Surgery.
University of Michigan, Dental Department.
University of California, Dental Department.
Louisville College of Dentistry.
Harvard University, Dental Department.
Seventeen schools reporting on Operative Technics.

1. *How do you teach tooth forms, surfaces and surface markings?*

Answer—Didactic, eleven colleges; recitative, ten colleges; models, nine colleges; drawings, fourteen colleges; actual teeth, fifteen colleges; drawings by students, two colleges; modeling in clay, three colleges.

2. *How do you arrange for holding the teeth while filling, in pulp chamber and canal study?*

Retention of these blocks and teeth by teacher, mentioned by one college; blocks and sealing wax, twelve colleges; invest in plaster, five colleges; napkin, one college.

3. *How many longitudinal aspects of pulp cavities do you expose in each tooth, and how many teeth does each student dissect?*

Single root, thirteen colleges report two aspects; one college, three aspects; molars, three colleges report two aspects; four colleges 3; one college four; one college five. No. of teeth dissected, two colleges one, one college ten. one college eleven, one college twelve, one college sixteen, one college eighteen, one college nineteen, one college twenty-two, one college 30, one college unlimited, two colleges evasive.

The average dissection by the eleven colleges reporting, fourteen and one-third.

4. *Do you have transverse sections cut? If so, how many cuttings to the tooth?*

Two colleges do not have transverse sections cut. The others dissect three to five teeth and cut from two to five cuttings to each tooth.

5. *How many silhouette prints of each dissection required?*

No. of silhouette prints, four colleges none, two colleges two, one college three, one college four, three colleges four to six, one college five, two colleges six, one college seven, two colleges no limit, two require duplicates. Average, four and one-half.

6. *What color of ink used?*

Twelve black, one black or purple, one to suit student.

7. *Do you require the interzonal line between enamel and dentine to be shown in the prints?*

Ten colleges, yes; seven colleges, no.

8. *Do you make dissections and silhouette prints of deciduous teeth?*

Six colleges, yes; eleven colleges, no.

9. *Do you have any trouble securing enough teeth for class work?*

Thirteen colleges, yes; four colleges, no.

10. *What Dental Anatomy do you use as a text-book? and is each student required to possess himself with a copy?*

Sixteen colleges, Black's; one college, Black's or Tomes'. To possess, nine colleges, yes; eight colleges, no.

11. *Do you have students draw pictures of surfaces of teeth? and, if so, about how many?*

Five colleges, yes; eleven colleges, no; one, occasionally. Number of pictures—One college, twenty to twenty-five; one college, thirty to forty; three, not stated.

12. *What size drawings (length), and on what kind of paper?*

One college, one and a half to two inches on kindergarten crayon paper; one college, not uniform; one college, size of print book page, same paper; one college, three times natural size, white book paper; one college, five inches, on drawing paper.

13. *Do you have students draw pictures of dentine, enamel, cementum and pulp tissue, as shown under the microscope?*

Four colleges, yes; thirteen colleges, no; several report, "yes, this is done in the histological department." These I report no, because it is not done in the in the operative technic department.

14. *Do you have students make models of teeth in clay? If so, what size and how many?*

Twelve colleges, no; one college carves one to three teeth from four to eight inches; one college, five teeth, six inches; one college five teeth and several occlusal surfaces, four inches; one college carves from plaster and one college carves from white soap.

15. *Do you use clay for purposes of demonstration before your class?*

Five colleges, yes; twelve colleges, no.

16. *How much time is given to the anatomy of the teeth, including silhouette printing, drawing and modeling, and in what part of the course does it come(first—middle—last?)*

The answers to this question have been given from various standpoints. By some, the work was apparently done in the lecture room; others reported both the work of the Professors of Anatomy and Operative Technics; while others reported only the work of the teacher of operative technics, which was the desired information.

One college, one month, first of second year; one college, two months, first of first year; three colleges, three months first of first year; one college, four months first of first year; two colleges, five weeks—one the first, the other the last of first year; one college, thirty hours, first of first year; one college, fifty-two hours first of first year; two colleges, seventy hours; one college, eighty hours; one college, ninety hours; one college, one and a half years; every college teaches dental anatomy, but from the answers to this question, they vary from one month of one, and thirty hours of another, to one and a half years of another.

17. *Do you teach instrumentation?*

Thirteen colleges, yes; four colleges, no.

18. *Do you have a list of instruments required for each student in operative technic work?*

Seventeen colleges, yes.

19. *Do you have students make models of required or other instruments in brass or other metal?*

Four colleges, yes; thirteen colleges, no; only one reporting number, and that twenty to thirty in brass Other colleges have this work in the metallurgical technic.

20. *Do you teach cavity preparation? If so, how many and what forms of cavities, etc.?*

Two colleges teach two forms, in this course; one college, three forms; three colleges classify, per Weeks, and ten colleges teach all forms.

21. *Do you have students prepare cavities in extracted teeth or some other substance?*

Four colleges use teeth; four colleges, ivory; eleven colleges, bone.

22. *What filling material handled and how many fillings required of each?*

Eight colleges use gold; sixteen, amalgam; seventeen colleges, cement; nine colleges guttapercha; fifteen colleges, tin; one college,

sandarac and cotton; two colleges, preparation of guttapercha; one college, oxychloride zinc; one college, Cu; two colleges, combination of tin and gold; two colleges report three of each; one college reports fourteen in all, and two colleges report twenty-four in all. The others do not state definite number.

23. *Do you explain to students in this course the meaning of any technical terms, and if so, about how many?*

This question variously answered: One college, 100 words; one college, 75 words; one college, large number; one college, some; one college, most common; four colleges, yes; two colleges, as met; one college, each when met, all required, all necessary, all that come up, try to all.

24. *Do you teach the chemistry of the different tooth structures?*

Three colleges report teaching more or less this subject in technic; fourteen report no; but some state it is taught in chemistry

25. *Do you teach any histology in this course? If so, how much, and with what facilities or helps?*

Two colleges report rudiments; two colleges report cuttings for microscope. The others report no, except several say yes, and then make it apparent that they refer to the regular chair of Histology, so we could not count it as taught by the chair of Operative Technics.

26. *Do you teach any pathology in this course? If so, how much?*

Five report yes, but confined to rudiments. The others report no; some explain that it is confined to the chair of pathology.

Two outlines given—

1st. Pulpitis; septic conditions of pulp chambers and canals, also cases in which the septic condition involves the apex and peridental membrane.

2d. Exposed dentrine, exposed pulps; congested pulps, inflamed pulps; dead pulps $\left\{\begin{array}{l}\text{putrid,}\\\text{mumified.}\end{array}\right.$

Alveolar abcess $\left\{\begin{array}{l}\text{Blind or sleeping,}\\\text{Fistulous}\\\text{Acute,}\\\text{Chronic.}\end{array}\right.$

Pericementitis.

27. *Do you teach any therapeutics in this course? If so, how much?*

Eight colleges report yes: principally elementary instruction in the drugs used in technic work; nine colleges report no; some

state "Confined to the chair of Therapeutics and Materia Medica," which we assume is the case of all reporting no.

One outline given, as follows: Enough to cover pathological course; some five classes of remedies, two or three remedies of each class.

28. *How do you have students arrange teeth to represent a dummy patient?*

Two colleges report yes; five colleges, no; five plaster or sealing wax; two Weeks' dummy; one block, one dummy boxes; one explains: "Set six or eight teeth in box with gutta percha; when tooth is finished extract and transplant another." Another, "Take impression in modeling composition, set in teeth, and pour with plaster."

29. *Do you have students apply therapeutic remedies to supposed pathological conditions in teeth of "dummy patient?" If so, how many each.*

Four colleges report yes; eight colleges, no; one college, three to ten of each remedy; one college, extensive. one college, nine divisions of each; one college, one of each; one college, nine teeth.

30. *Do you teach distinctions between different forms of alveolar abcesses?*

Twelve colleges report yes; five colleges, no; one college teaches fonr; one college teaches two kinds.

31. *Do you teach methods in root cleaning and filling, and how many? If so, how much required of each student?*

Seven colleges report yes; five or six colleges require eight to ten pulpless, treated, cleaned, dried, and filled, some opened and examined; three colleges, teeth treated and filled; two colleges, fill fifteen canals; two, canals each chlo. p. wax, Oxy. Ch Zn; three, one of each; six, root fillings, four to six each.

32. *Do you teach tooth bleaching in this course? If so, in natural teeth or vegetable growths, with test tubes or beakers.*

Seven colleges report yes, natural teeth. (One college uses tubes or beakers with colored flowers mostly; describes modus operandi of bleaching teeth in mouth).

33. *Do you teach methods of pulp capping and pulp devitalization? If so, how—by didactic instruction, or actual application of drugs or remedies to tooth in dummy?*

Twelve colleges report yes, No. 5.

34. *What text book or manual of operative technics do you use in your course?*

Thirteen colleges report Weeks'; some optional with student, three none; one, standard works on operative dentistry.

35. *How many hours each day, how many days each week, and how many weeks occupied in operative technic class work?*

Sixty, ninety, two of 108, 128, 144, 150, 180, 192, 216, 270, 360 hours. It is quite apparent the time stated includes more than operative technics in some cases. Prof. Cattell used 192 hours.

36. *What are your three most prominent objects in teaching operative technics.*

"To get some ideas of practical dentistry into their heads."

"Regional anatomy of the tooth, formation of cavities, manipulation of fillings."

"Studying forms of root canals, shaping cavities, studying character of tooth; bone, enamel, cement, dentine."

"1. Training of eye, judgment and fingers; 2. familiarizing students with forms of the teeth, and the forms and varieties of pulp chambers and root canals; 3. familiarize students with filling materials, and best methods of manipulation."

"Study anatomy of the teeth; insight into various operative procedures; manual training."

"Skill in handling instruments, knowledge of anatomy of teeth, forming and tempering instruments."

"Cause of decay, principles involved in reparative treatment, and successful tooth filling."

"Accurate knowledge of the organ on which student is to spend his life's work; to train hand and eye as well as the brain; to give confidence in work before operating on subject."

"To teach tooth forms and characteristics, teach principles underlying operative procedures, to train the fingers to execute what the mind has learned."

"To teach specific operations, proper instruments to be used, to train hand, eye and mind together."

"Familiarity with anatomy of the tooth, manual dexterity, and principles of filling."

"Preparation of cavities, filling of same, dental anatomy and treatment of diseased teeth."

"To familiarize student with tooth forms, manipulation and adaptation of filling materials."

"Familiarity with teeth, handicraft or manual training, order and system."

37. *What is your class motto?*

"Work."

"The boys think it ought to be "Dig."

"If careful in little things, the big ones trouble not."

"Gentlemen are { Respectful, Courteous, Pleasant."

Respectfully submitted,

GEO. H. WILSON, *Secretary of Board of Directors.*

PROCEEDINGS

OF THE

NATIONAL SCHOOL

OF

DENTAL TECHNICS

FOR THE YEAR 1897, CHICAGO

PUBLISHED, 1898

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OFFICERS

—OF THE—

NATIONAL SCHOOL OF DENTAL TECHNICS

1893-1894-1895-1896-1897.

Organized at the World's Columbian Dental Congress, Chicago, 1893.

1893

President, D. M. Cattell. Secretary, J. A. Dale.

Committee on Constitution and By-Laws,

T. E. Weeks, H. P. Carlton J. A. Dale.

1894

President, D. M. Cattell. Vice-President, T. E. Weeks.

Secretary and Treasurer, J. F. Stephan.

Executive Board,

T. E. Weeks, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1895

President, T. E. Weeks, Vice-President, S. H. Guilford.

Secretary and Treasurer, J. F. Stephan.

Executive Board,

D. M. Cattell, 3 years; N. S. Hoff, 2 years; H. W. Morgan, 1 year

1896

President, H. W. Morgan. Vice-President, S. H. Guilford.

Secretary and Treasurer, J. F. Stephan.

Executive Board,

G. H. Wilson, 3 years; D. M. Cattell, 2 years; N. S. Hoff, 1 year.

1897

President, G. V. Black. Vice-President, N. S. Hoff.

Secretary and Treasurer, D. M. Cattell.

Executive Board,

G. E. Hunt, 3 years; G. H. Wilson, 2 years; D. M. Cattell, 1 year.

INTRODUCTORY.

The Fifth Annual Meeting of the National School of Dental Technics, was more largely attended and greater interest was shown in its proceedings than any previous meeting. The executive officers believe a report of its proceedings is of sufficient value and importance to justify its publication in full and preservation in the form here presented. By this means it is desired that a copy shall be placed in the hands of every teacher in our profession, with the hope that his interest and help may be secured to help formulate a more uniform system of teaching technique. By such an interchange of views and experiences we hope to accumulate data showing what has been accomplished by different methods and to be able to make such selections as shall enable us to do our work with more definiteness and facility.

With the hope that a careful perusal of these proceedings may stimulate all teachers to participate in the next meeting of the School which will probably be held in Cincinnati, the last week in December, we respectfully submit this second volume of the published transactions of the National School of Dental Technics.

THOMAS E. WEEKS,
N. S. HOFF,
GEORGE E. HUNT,
Editors for the Executive Board.

THE INLAND PRESS,
Ann Arbor, Mich.

TABLE OF CONTENTS.

Proceedings of the Fifth Annual Meeting.

PALMER HOUSE, CHICAGO,
WEDNESDAY, Dec. 29th, 1897, 11 A. M.

The 5th annual meeting of the National School of Dental Technics was called to order with President Henry W. Morgan in the chair, who opened the session with appropriate remarks.

Minutes of previous meeting read and approved.

The roll call of Colleges showed 21 accredited delegates present, as follows:

Northwestern University, Dental School.
University of Minnesota, College of Dentistry.
Vanderbilt University, Dental Department.
University of Michigan, Dental Department.
Western Reserve University, Dental Department.
University of California, Dental Department.
University of Iowa, Dental Department.
University of Buffalo, Dental Department.
Royal College of Dental Surgeons.
Louisville College of Dental Surgery.
Chicago College of Dental Surgery.
Ohio College of Dental Surgery.
Indiana Dental College.
Western Dental College.
Kansas City Dental College.
Baltimore College of Dental Surgery.
Philadelphia Dental College.
Atlanta Dental College.
Northwestern College of Dental Surgery.
Detroit College of Medicine, Department of Dentistry.
Marion Sims College of Medicine, Dental Department.

Dr. Hoff, Chairman of the Executive Board, presented the report on the publication of the proceedings of the last four meetings (from the time of organization), and presented copies for distribution. The report was accepted and approved.

Dr. Hoff submitted the following program for the present session, and by vote it was made the regular order of business:

WEDNESDAY, DEC. 29.

11:00 A. M.—Organization; Executive business.

2:00 P. M.—"Prosthetic Technique; Principles Involved and a Method."

By N. S. Hoff.

3:00 P. M.—Discussion: "New and Successful Methods."

Exhibition of Results.

8:00 P. M.—"Instrument Nomenclature with Reference to Instrumentation."

By G. V. Black. To be followed by a general discussion.

THURSDAY, DEC. 30.

9:00 A. M.—"Dental Anatomy and Operative Technique."

By Thomas E. Weeks.

10:00 A. M.—Discussion: "Improved Methods."

Exhibition of Results and Facilities.

1:30 P. M.—Symposium on General Teaching Methods, especially those not already considered.

Conducted by S. H. Guilford.

8:90 P. M.—Report of Executive Board on Technic Courses in the Schools.

G. H. Wilson.

Election of Officers and Adjournment.

We hope to have results of class work sent in from all membership schools.

The exhibits of class work under W. J Brady (Master of Exhibits) will be open for inspection before and after sessions.

WEDNESDAY, Dec. 29, 1897. 1 P. M.

President Morgan in the chair. Fifty-five delegates and visitors present.

The Executive Board presented a favorable report on the applications for membership of the Missouri Dental College, the Milwaukee Medical College, Dental Department, and the Ohio Medical University, Dental Department.

A favorable ballot was cast for the above named Colleges and they were declared elected to membership.

The proposed amendment to Article II of the By-Laws of the Association, which was submitted last year and laid over till now, was again read for action. The amendment reads:

"SECTION II. The Executive Board may appoint either one of its own members or any other member of this body as a Master of Exhibits, who shall provide for, receive, arrange and care for all exhibits at the meetings of this body."

By a proper vote the above amendment was adopted.

The President, by full consent of the delegates, tendered the courtesies of the floor to any visitor or guest who wished to discuss any of the papers presented.

The first number on the program, "Prosthetic Technics; Principles Involved and a Method," was presented by Dr. N. S. Hoff.

Discussion by Drs. Weise, Foster, Smith, Wilson, Carlton, Hansen, Brown, Brady, Webster, Cattell, Weeks and G. V. Black, with Dr. Hoff's closing remarks.

Dr. A. H. Smith moved the appointment of a committee of three by the President, with Dr. Hoff, chairman, to formulate a syllabus that will be a guide in teaching Prosthetic Technique. Motion passed and Drs. N. S. Hoff, G. H. Wilson and H. J. Goslee, were appointed as said committee.

Minutes approved. Adjourned.

WEDNESDAY, Dec. 29th, 1897, 8 P. M.

President Morgan in the chair.

The second number on the program was then presented—Dr. G. V. Black's paper on "Instrument Nomenclature, with Reference to Instrumentation."

Discussed by Drs. Snow, Smith, Harlan, and Crouse, Dr. Black closing the discussion. Owing to the lateness of the hour, many refrained from expressing their views.

Minutes approved.

Adjourned.

THURSDAY, Dec. 30th, 1897, 10 A. M.

President Morgan in the chair.

Third paper on program—"Dental Anatomy and Operative Technique," by Dr. T. E. Weeks.

Discussed by Drs. Foster, Carlton, Brady, Brown, Patterson, Harper, Webster, Cattell, and Black, Dr. Weeks closing.

Dr. Otto Arnold moved a committee of three be appointed by the President with Dr. Weeks as chairman, to prepare a syllabus on Operative Technics. Motion passed and President appointed Drs. T. E. Weeks, W. E. Harper, and J. A. Dale.

Minutes approved.

Adjourned.

THURSDAY, Dec. 30th, 1897, 2:00 P. M.

President Morgan in the chair.

Fourth number on the program—Dr. H. S. Guilford's talk, "A Symposium on General Teaching Methods."

Discussed by Drs. Hoff, Foster, Harper, Noyes, Arnold, Smith, Hunt, Brown, Patterson, Webster, Black, and Snow.

By motion, the subject was passed, Dr. Guilford having nothing more he cared to add.

The fifth number on program—Dr. Geo. H. Wilson's report (for the Executive Board) on Technics in the Colleges of the School, was read by title, and will appear in the published proceedings.

The sixth and last number of the program for the present meeting, the election of officers for the ensuing year was proceeded with, and resulted as follows:

President, Dr. G. V. Black, Chicago, Ill.

Vice-President, Dr. N. S. Hoff, Ann Arbor, Mich.

Secretary-Treasurer, Dr. D. M. Cattell, Chicago, Ill.

Executive Board, Dr. G. E. Hunt, Indianapolis, Ind., three years, with Dr. Geo. H. Wilson, remaining for two years, and Dr. D. M. Cattell remaining for one year.

Dr. Kennerly moved the recommendation of Omaha as the next place of meeting, and in conjunction with the National Association of Dental Faculties as the time.

The newly elected President was escorted to the chair and greeted by the retiring officers with pleasant remarks, which were responded to by the President-elect in appropriate words.

There being no further business to transact, the meeting adjourned, after minutes were read and approved.

D. M. CATTELL,

Secretary-Treasurer, by appointment.

NOTE.--After adjournment, by invitation of the Chicago College of Dental Surgery, through its Dean, Dr. Brophy, all members and guests met at 6 o'clock at the Union League Club, and were there regaled from a bountifully filled table prepared especially for our needs and edification. A happy circumstance being the fact that this College was the first to introduce into its course of instruction the department of Operative Technics.

Prosthetic Technique.

N. S. HOFF, D. D. S.

The first indication in literature of a systematic effort to teach dental technics occurs in a series of articles published in the *American Journal of Dental Science*, in 1840 and 1841, under the title of "A Treatise on Mechanical Dentistry," by Solyman Brown, M. D., D. D. S. These articles appeared as contributions to the *Journal* and were not presented in the class room. But according to Dr. Chapin A. Harris there were nearly 1,200 persons practicing dentistry in the United States at that time, scarcely 200 of whom ever had any opportunity to learn the essentials of practice from a practitioner of recognized ability. These contributions to the new Journal met the needs of these practitioners and from our present point of view, did it in a fairly satisfactory manner.

The Baltimore College of Dental Surgery had just been organized with a faculty of four teachers, one of whom, Dr. Harris, was a dentist, and held the chair of Practical Dentistry. It does not appear, however, that any effort was made to impart instruction in dental technics in any other manner than clinically.

The following extract from the 5th annual announcement of the Baltimore College of Dental Surgery, probably directs attention to the first effort made to systematically train students in Mechanical Technique: "The most untiring efforts are devoted to teaching Mechanical Dentistry. A convenient work room has been fitted up for this purpose, and pupils have the advantage of making all the preparations and performing the manipulations under the eye of an experienced teacher. As it has been very incorrectly supposed, that the education was merely theoretical, we desire, particularly, to call attention to this part of our announcement. To secure excellence in this department, the faculty has secured the service of a skilled Mechanical Demonstrator—T. B. Savier, D. D. S.—who will constantly afford instruction to pupils while engaged in the work room. Indeed, such facilities have been provided, and such stress is laid upon this department, that it must be the fault of the student himself if he does not become well versed in the Mechanics of Dental Art."

From this first effort to teach dental technique by the laboratory method we can readily trace the history of the development to the present time when we find splendid facilities and much valuable time given to the teaching of not only Prosthetic but Operative Technique on the laboratory plan.

It is unquestionably true that the curriculum of to-day is more extended and more varied; but the general lines of work included under the head of Mechanical Dentistry, are much the same as taught by Dr. Brown. For several years after the inauguration (about 1876) of crown and bridge work, it was considered an operative procedure and was reported in the American Dental Association by the section on Operative Dentistry until 1891, probably for the same reason that regulating methods are still reported by the section on Operative Dentistry: namely, the difficulty of entirely separating operative from the mechanical procedures.

This introductory will serve, I hope, to prepare us to consider a few questions which it seems to me are important in teaching this part of our curriculum in an orderly and comprehensive manner.

***First**, what shall we include in the course under the head of Prosthetic Technic?*

In endeavoring to present my own thought here, I cannot refrain from stating that, I think almost the entire field of Practical Dentistry could be advantageously presented to the mind of the student, in some sense at least, as a purely technical study, and largely by technical methods. But as this is a larger subject and one likely to lead to discussion not pertinent to the object of this presentation, we will confine our consideration to the teaching of subjects that are of unquestioned relations to what we formerly termed Mechanical Dentistry, and which are largely taught by the laboratory methods.

Plate work, rubber, cast metals, swaged metals and porcelain plate work, will fall under this classification without question, and for the same reasons crown and bridge work, with the possible exception of certain styles of porcelain crowns requiring little or no mechanical manipulation by the Dentist for adaptation. The manufacture of instruments and in some degree their use, or instrumentation, if not purely mechanical, can be best illustrated by the instructor, and learned by the student in the laboratory. The construction of regulating appliances is a peculiarly mechanical process, and can also be taught nowhere else so effectively. The construction of cleft palate vela and the various stays and splints for securing fractures of the jaws and face, can be within certain limits impressively taught in this manner. The subject of metallurgy while it is necessarily mechanical in some of its processes, is a science purely, and can be more conveniently and efficiently taught in the chemical laboratory, or at least associated with some branches of chemistry. It is, however, in many schools effectively taught as a part of the Prosthetic course.

Without going into a lengthy discussion of the reasons for this conclusion, we will accept common practice as consent and affirm that a course in Prosthetic Laboratory Technics then should embrace, so far as time and opportunity may allow, Plate, Crown, Bridge work and the manufacture of instruments and regulating devices, also the manufacture of splints and cleft palate appliances.

The next question we would ask is when in the course should these subjects be taught and how much time should be given them?

In order to answer this question satisfactorily it will be necessary to determine the relative importance of these branches as well as to establish a theory which shall determine the proper place and time for teaching them in a logically graded course of inductive teaching. If it be only knowledge of technics that is to be gained by the student, then perhaps it would be well to place the teaching

of these subjects in the last or third year of the course. But technical knowledge, however perfect, is not technical skill, which is of so much importance that its cultivation should be provided for early in the course, because it is fundamental. Technical knowledge, however varied, will be of little practical benefit, if skill to execute be lacking. And still further, technical skill once acquired can not be easily lost and will be one of the important, if not essential, factors in gaining knowledge. The man with skilled handcraft has one of the best incentives to secure further knowledge. The man lacking skill meets so many discouraging accidents, which the skillful man finds easy and enjoyable, as to drive him to expedients of questionable character to accomplish his work and his interest and enthusiasm suffer in consequence.

Unqualified men are practicing operative dentistry exclusively, because they lack the necessary skill to perform creditable work in Prosthesis. In passing we may also remark that this statement could be reversed and made to apply to some Prosthetic specialists But the probabilities are very great that the student who qualifies himself thoroughly in mechanical technique will very generally make rapid progress in attaining skill and facility as an Operator. Therefore I contend that one of the greatest advantages of a technic course in Prosthetic Dentistry is to use it to develope hand and finger craft which shall be available for all kinds of practical work of either the Prosthetic or Operative character. And every laboratory course in Prosthetic Dental Technique should be planned with this idea carefully worked into it. So that the course shall be of the proper character and of sufficient extent to best bring this result to pass, and effort, *even special effort*, should be made to inculcate or develop this faculty in the student, and if found lacking or impossible of development, such students should be advised to discontinue seeking such acquirements as soon as it can be demonstrated that they lack these essentials.

I hope I shall not be understood as intending to depreciate the value of inculcating knowledge, but the fact is that every student wants to know *how* to do it, and seems willing to stop there. when he should strive for greater efficiency. Every teacher of laboratory technique has had to meet the question, "is this plate, or this crown practical?" If the answer is in the affirmative, the student is content and assumes the tasks with resignation at least,

We teachers want to get clearly the idea that there is more than one quality to the food, we are giving to our students. We should thoroughly grasp the idea that to impart knowledge is

only a part of the work to be done and realize that we must cultivate brain, hands and will until we secure enthusiastic co-operation. If we can so arrange a course in Prosthetic Technique and so teach that course as to impart knowledge, and train the hands, and get a hearty interest in the work for its own sake, we shall soon find we have gained an important advantage. Is it possible a course of study and work can be planned and so effectively taught as to result in this desirable end? I am inclined to think that much may be done to make our teaching more interesting by discussing together this branch of our curriculum with the hope of formulating some uniform course and methods of imparting instruction in this, *one* of the most difficult of all the practical branches to teach. If it is possible to prepare a course that shall meet the approval of earnest and conscientious teacher, which shall enlist the hearty co-operation of the students, it seems that most of the difficulties in the way of teaching this subject successfully would be met.

The teaching of prosthetic technique has an important function in determining the character of the work done in other technical branches and it should precede all other such studies. In almost every school where any attempt is made to maintain a graded course of study this course is adopted, indicating in general terms at least a uniformity of sentiment, in regard to this matter. But from my own observation of the methods employed for systematizing this technical course, it is adopted apparently too often, not to meet any well considered scheme which is calculated to develop systematically technical skill, but to suit convenience of management, —that is, to accommodate teachers; or to keep the students employed; or for economical or eccentric reasons, unmindful if not regardless of the best interests of the students.

One of the strongest reason for making Prosthetic Technique the fundamental in a well organized course is that it is so versatile. Some of its operations are very simple and easily acquired, while others are so exacting as to trip the artisan of very fine attainments in skill. For this reason it is admirably adopted to the purpose of developing skill in hand-craft.

The freshman student can be inducted successfully into the more intricate technicalities, beginning with simpler forms which he can readily compass, with what skill nature and former occupations may have endowed him.

It will be evident then, if my position has been well taken, that this is a beginner's course, and should be taken up as one of the

important first year studies, and the time devoted to it should be consistent with its importance. The two factors which measure its importance are, first, its essential or inherent value for itself; second, its relative influence in the development of other technical functions, and as an aid in determining the adaptability of students to this kind of work.

If we are to include all the subjects in the outline given above in this course, namely; plate, crown, bridge work, regulating devices and instrument manufacture, and, are expected to execute a specimen of each piece of work involving such an extended variety of principles as are necessarily involved in the construction of such specimens, more time will need to be given to this course than would be at the command of even our long term schools and all other studies would necessarily be set aside. To compass the amount of work required in plate work alone would tax the shorter term schools greatly, so that it will not be practicable, should we so desire, to complete the course in a single year. But its importance demands that it should have a major part of the first year even to the exclusion of other important collateral studies. Because on its own account this work should be well done, and students can not be *over-trained* in it, and again because of its important function in determining the character of the student's future, it is desirable that he be given the fullest liberty to prove that he has an aptitude for the calling he has chosen. Manifestly the larger his opportunity the clearer will be the evidence and the greater the probability of arriving at correct judgment. In former times an apprenticeship in a dental office was considered essential as a preliminary preparation for admission to college. This apprenticeship varied in time from six months to four or five years; it is still two years in England, where, however, the same time and attention is not given to technical training in the schools as here. The schools have materially reduced this time to nominally six months, but actually an average of 480 hours, or counting eight hours as a days work, to 60 days or two months of full work. This calculation is based on a six months school having twenty-four weeks of actual work time, and giving one-half of each day or twenty hours per week to prosthetic laboratory technique. Considered in this way it is evident that the time is insufficient. Clearly this time should be extended or methods of imparting instruction must be improved so as to enable the student to accomplish the necessary amount of work in this short time. If it were practicable some relief could be secured by requiring some preliminary training before admitting the student

at all to college. It seems reasonable then for us to ask that more time shall be allotted to this work. The continued broadening of this field manifestly demands that methods of giving instruction should be improved or at least modified. As a brief summary of my answer to this question then I should say that the importance of skillful attainments alone, not to mention the other good reasons, demands that these subjects, plate, crown, bridge work, regulating devices, and instrument making should be more thoroughly taught in the technical courses than ever before; and that more time should be given to this instruction, at the expense, if need be, of some other less important collateral study, and my judgment based on experience leads me to think that the time should be concentrated as much as is practicable; and above all it should be a beginners course.

The next question I would propose is, how shall Prosthetic Technics be taught?

There are three distinct methods, each one it is true more or less closely related to the other, yet sufficiently distinct to make a classification easy.

They are 1st, by the lecture or didactic plan;

2d, by the lecture and laboratory plan combined;

3d, by demonstrations and laboratory methods.

The first and oldest is that which because of the unusual talents demanded of the teacher and the large classes to be instructed, has fallen much into disuse. It is the lecture system, and requires, to make it successful, that the teacher shall first have a natural or acquired faculty of thinking clearly and expressing his thought in a forcible and attractive way. It is a somewhat cumbersome and tedious process unless the teacher is possessed of fine capacity for holding the attention of his class. Then, again, the student complicates more or less the problem, as it too often, perhaps happens, that through lack of perception, because of faulty methods in his preparatory training, or his natural capacity to take full advantage of his opportunities, he is not capable of following a logical presentation to the conclusion intended, and as a consequence this ideal, (in many respects at least) method of imparting instruction has been largely abandoned, where large classes of diverse capabilities are to be taught. With conditions as they are it cannot be used altogether because of the fact that it is burdensome to the instructor and unsatisfactory in result to the student. If our system of Prosthetic procedure was crystalized into uniformity or even to a degree of definiteness that would enable its presentation by a capa-

ble instructor in so forcible and attractive a manner as to enable the average student to retain the ideas firmly enough to remember them until he has them fixed and classified them in his own way, then we should get from this method not only the instruction given by the teacher but an intellectual process that would be of great value. But perhaps the greatest drawback to this method is that it leaves out almost entirely the manual training feature, which is essential to the development of the skillful artisan.

To meet this last difficulty a combination of class and laboratory instruction has met with considerable favor, and this method is in vogue in most of our schools to-day. It involves essentially the presentation of the principles, so far as any principle can be demonstrated, together with personal instruction involving these principles in the laboratory.

This method has its advantages when properly carried out. To get the best results, it can only be used where the classes are small, and where the instructor gives the lecture course and also the laboratory instruction. This is essential in order that confusion may be avoided and that uniform results may be secured. When given at its best it will result in artistic and scientific results, in just so far as the instruction has partaken of these characteristics. If the teacher is able, enthusiastic and devoted, his students will partake of this quality. I hope I shall not create any feeling of resentment or convey the impression that I would disparage the quality of the work done by our teachers in this connection. But the simple fact is evident to any one who has had even a little experience in conducting dental college work, that men of requisite abilities cannot, or at least will not, sacrifice the time and thought necessary to do this work in a way to secure the best results from it. The wages paid teachers will not in many instances justify them in giving the time required. Too often we can induce such men to spend two or three hours each week to give a course of lectures provided some other person whose time has not so much monetary value can be found to attend to the laboratory instruction. And just here is where the work suffers, or at least may suffer injury and possibly the entire course fail of accomplishing what it should. For when a second man undertakes to carry on another's work, if he be ever so conscientious and willing, he will intuitively and unintentionally introduce his own personality to the extent of modifying the impression first made, resulting many times, because of inability on the student's part to discriminate between the personal influence of the different individuals, in confusion or harm. He is lead to think

there is a diffeience in the method or principle because it has been presented to his conception from a different standpoint. And because of this confusion the student is placed in an attitude of uncertainty which is fatal to his enthusiasm. And when you kill a student's interest, especially his enthusiasm, you have materially incapacitated him. If it were possible to conceive of two or more persons, or if it were practicable to get together in this work two persons of the same mental and moral qualifications and who would take the trouble to carefully follow each other, this system would meet with good results. It is surprising to see the good results that oftentimes come from very indifferent work. It must be in spite of rather than because of systematic effort on the teacher's part, or the method of presenting the work.

This practical difficulty has resulted in some schools, in the modification of former plans of presenting prosthetic téchnique work. In fact it has divorced practically the purely technical from what we may call the artistic or practical aspect of Prosthetic Dentistry.

As a consequence we have a lecture course on the scientific and artistic aspects of Dental Prosthesis; and a course based on this other feature, which is calculated largely to illustrate and inculcate the magistral or manual aspect. In other words we have separated prosthetic technique, so far at least as construction of appliances is concerned, from prosthetic art. And each one is taught by a method which is best calculated to develop in one case the dental artisan, and in the other the dental artist.

I am aware of the fact that the conservative spirit of some of our better educators is contrary to this proceeding of divorce, holding that because of this separation the whole course will suffer. I myself am not sure but there is a danger in this direction, but the circumstances outlined above have brought new conditions which can not be met by former methods. The whole subject of Dentistry has broadened to the extent that it has developed fields for specialists. In the beginning of this paper we called attention to the fact that it was practically impossible to teach all of Prosthetic Technique in an up to date manner without neglecting seriously other important collateral studies. Since crown and bridge work has attained its present proportions it has almost overshadowed plate work, and when we add to this the work introduced by modern methods in orthodontia and cleft palate work, it seems as though we were abundantly justified in creating a new department where

these subjects may receive undivided attention from both instructor and pupil.

The subject of Prosthetic art could in this way receive more careful treatment at the hands of a specialist, and the presentation of this subject free fróm unnecessary technical associations should result in a more ready conception and comprehension by the student. And on the other hand the valuable function of the laboratory course in developing skillful artisans can be more forcibly presented without regard to artistic entanglements. The treatment of the subject from the artistic standpoint is capable of and really demands a more scientific consideration than it now has. I am aware that some good work has been done in this direction, but too much of it is desultory and not comprehensive. I would not completely sever the relations of the two departments, but teach them harmoniously.

The following synoptic scheme will illustrate the idea I wish to commend for teaching Prosthetic Technique systematically and comprehensively. Incidentally I want to say that it has been on trial in the University of Michigan for several years past and is continually developing and growing in favor. It is all completed by the middle of the second year, allowing the balance of the time for Operative Technique.

First. Taking impressions in wax (one student of another) for 4 days,—20 hours.

Second. Taking impressions in modeling compound (one student of another) for 6 days,—30 hours.

Third. Taking impressions in plaster (one student of another) for 10 days,—50 hours.

Fourth. Rubber plate, no teeth, afterwards broken and repaired, for 5 days,—25 hours.

Fifth. Partial upper articulated to partial lower, each tooth representing a peculiar grinding and investment, 10 days,—50 hours.

Sixth. Full upper vulcanite plate with section teeth, to articuwith, full lower fusible alloy base and teeth attached with vulcanite, 10 days,—50 hours.

Seventh. Full upper alluminum, plain teeth attached with vulcanite, to articulate with partial lower fusible alloy, 10 days,—50 hours.

Eighth. Full upper brass plate teeth attached with vulcanite. Ground to articulate with partial lower brass plate, with clasp, band, and teeth attached with solder and vulcanite, 12 days,—60 hours.

Ninth. Small silver saddle plate with two teeth, wire clasp and band, 5 days,—25 hours.

Tenth. Crown work. Metal shell crown for molars and bicuspids, two or more of each kind; (*a*) stamping cap with die plate, (*b*) carving cap and reproducing with fusible alloy dies, (*c*) seamless crowns, 12 days,—60 hours.

Eleventh. Bicuspid shell crowns with porcelain face; (*a*) according to the Hollingsworth method, (*b*) according to the Case method, 8 days,—40 hours.

Twelfth. Capping, banding and tubing a badly decayed incisor or cuspid root for Logan or Darby crown, 5 days,—25 hours.

Thirteenth. Capping and banding an incisor root with post, attaching porcelaine face or plate tooth with solder, 5 days,—25 hours.

Fourteenth. Capping and banding an incisor root with post attaching plate tooth with low fusing porcelaine, 5 days,—25 hours.

Fifteenth. Inserting lateral incisor and first bicuspid bridge teeth by means of open faced bands on cuspid and second bicuspid teeth, 10 days,—50 hours.

Sixteenth. Inserting lower second bicuspid and first molar with shell crown attachments to first bicuspid root and second molar tooth, 10 days,—50 hours.

Seventeenth. Inserting lower incisors with shell crown attachment on incisor and open faced band on cuspid, 10 days,—50 hours.

Eighteenth. A full upper continuous gum plate 10 days,—50 hours.

Nineteenth. One straight enamel chisel, forged from three-sixteenth octagon steel rod; shaft, shank, and blade are then roughed out with file and afterwards polished, tempered, shaft blued, shank and blade finely polished and burnished. Every part must be done by hand, care taken as to definiteness in filing, polishing, and tempering, 3 days,—15 hours.

Twentieth. Excavator made in the same way except that the entire instrument is burnished and attention directed to special temper necessary, 3 days,—15 hours.

Twenty-first. Plugger, made in same manner as above. The only difference made is in the serrating and tempering, 4 days,—20 hours.

Twenty-second. Four steel taps and filing instruments for making regulating appliancee. These are carefully and uniformly made four and one-half inches long with file-drawn-cut handles to facilitate holding in the fingers when using, also a double ended wrench, 5 days,— 25 hours.

Twenty-third. Drawing wire and making tubing from german silver for regulating appliances, also band material, 2 days, —10 hours.

Twenty-fourth. Making and adapting to plaster models a simple jack screw, a reciprocal jack screw, also some selected appliance, 8 days,—40 hours.

Twenty-fifth. One upper and one lower "coffin split plate," made to fit the mouth of the student's bench mate, to be fitted for inspection, 3 days,—15 hours.

Twenty-sixth. Making and adapting to plaster model of a regulating appliance made on the "Jackson System," 2 days,—10 hours.

In each case where the days and hours are stated it is supposed the student works five hours each day in the laboratory. This work is all first presented to the class in a demonstrated lecture; that is to say, every piece of work is made before the class, and each point in its construction explained. Each member of the class then reproduces for himself the piece of work he has seen demonstrated, zinc models being provided to secure uniformity in the work. It is important that sufficient work shall be allotted to occupy the average man's time until the next demonstration, and it is equally important that the class be kept together as nearly as is practicable. A demonstration every other day will provide ample work and for possible lapses of memory. Avoid giving out too much work in advance. Use time in the laboratory to correct misconceptions and preserve discipline. Reserve all instruction for the class room, so as to give the entire class the benefit of it. Keep in hand a small memorandum book, while in the laboratory for notes, and gather up all specimens which illustrate "how not to do it," for the class exercise. A portion of each hour should be devoted to criticising student's work. In giving demonstrations, work in various stages of completion may be passed among the pupils by an assistant to good advantage.

The advantages of this method are, that the work can be more systematically taught than in any other way; it can be more easily taught because done in class room and because of the system it can be more comprehensively taught; it stimulates the teacher to make thorough preparation as he must concentrate his whole effort into the demonstration hour, by so doing he saves himself the fatigue of continuous and monotonous repetition; and finally the more enthusiasm and skill the teacher exhibits, the more he will engender in his pupils.

Discussion of Dr. Hoff's Paper.

Dr. Weiss, University of Minnesota: I would like to present my work in this connection. I commend Dr. Hoff's presentation of this subject. He has presented it in a very able manner, and the course we pursue in the College of Dentistry in Minnesota is much along the same line as that which Dr. Hoff has presented. To begin with, in our course, we do not do as large an amount of technic work as he has presented, but embody about the same details in fewer pieces. We begin by taking impressions, using the different impression materials, and instead of beginning by taking impressions of each other's mouth as Dr. Hoff does, the students begin by taking impressions of a soft rubber model which resembles the mouth, with the different impression materials and comparing results. We do this for the reason that it enables the students to become familiar with the impression material before they begin working upon patients. I have here a metal model covered with soft rubber. It is one with marked undercuts and rugæ bringing out the defects met with in taking impressions. We take the first impression of the rubber model with modeling compound, and then an impression is taken with plaster. In that way students have opportunity to compare the two, and to notice the difference. Having made casts from the impressions taken of these rubber models with marked undercuts and rugæ it gives them an opportunity to see the defects. After that has been done with the use of both modeling compound and plaster for impressions, they take impressions of each other's mouths with both modeling compound and plaster and make casts of each jaw. Our students are divided into sections the same as by Dr. Hoff. They next take an impression of a model of the mouth for making a partial plate. We make a rubber plate where the teeth are ground to the gum, the teeth setting against the gum, and on one side we have restoration of the gum by rubber. This plate is broken and repaired. The next work consists of making a full upper and lower set of teeth on vulcanite base, according to Bonwill's law of articulation, using the Bonwill articulator. Those who have used this method of articulation know it is a great deal of work to grind up a set of teeth in this way. It takes a great deal more time than the ordinary method. This carries students along through the different steps of vulcanite work and prepares them for the metal work. Our first metal work is the swaging of an upper plate, taking impressions from metal models. The models used for

this work have well marked rugæ, with a high alveolar border, and pronounced tuberosities, not one that is flat, and smooth as is generally used for this work, making it a difficult case not only to swage, but one that is difficult to finish. After the plates are swaged and fitted to the model they are turned in for acceptance. They are required to fit the model when turned in for marking. The upper plate is rimmed on the outside only. The rim is not carried around onto the lingual surface, because our freshmen do not have a dental engine to use in grinding down the rim. It is next to impossible to bevel the rim on the lingual surface with an ordinary lathe, particularly where we have a plate with well marked rugæ.

The next piece of work consists of making a lower cast metal plate. That takes all the time they have for this work in the freshman year, and while some of them would not require all of that time, others do.

In the second year, when we have the dental engine, the first work is swaging an upper plate. This is fully rimmed and the teeth mounted to articulate with the lower natural teeth. Next we have the Chase combination plate, combining metal and vulcanite, using gum teeth. The next piece of work is a lower cast metal plate with metal cast to the teeth. All of these teeth are ground according to the Bonwill law of articulation, finishing the face of the lower cast metal plate with pink rubber. The next piece of work is making a partial plate and soldering teeth to it, and the next is a lower partial plate with clasps. That completes the technic work for the second year in plate work. In this year we introduce the orthodontia technic, beginning with making instruments. We first make the simplest form of an exploring point, and then proceed to the more complicated forms, such as wrenches and band drivers and band removers, that are to be used for practical orthodontia work. After that has been done they have the making of material from which orthodontia appliances are made, such as drawing the wire, soldering tubing, rolling band material, and so on. After this has been completed, I have made up a model which presents all the ordinary forms of irregularities that are met with. We have teeth inside and outside of the arch, rotated, etc., so that with a model of this kind appliances are made to fit as represented by this specimen (shows specimen). We have traction screws, jack screws, and different forms of appliances, illustrating the construction and application upon the model.

Then for the third year we have continuous gum work, and a partial plate with tho Condit method of retention. This completes our technic work.

Dr. M. W. Foster, of Baltimore: I would like to ask Dr. Hoff if he demonstrates bridge work to the whole class at one time.

Dr. Hoff: Yes. We do it to save time and repetition.

Dr. Foster: In this connection I will say that we divide our class into sections. We use all our classes in the freshman, junior and senior years in sections of eight men, and they go into the infirmary and extraction rooms in sections of eight. In our demonstrations of crown and bridge work we divide them into sections of sixteen men. In this way each student can get around the demonstrator and see exactly the work that is being done.

Dr. H. A. Smith, of Cincinnati, O.: I was very much pleased with the presentation of this subject. In this city there lived a dentist some years ago by the name of Allport, who did much for the profession of dentistry in the northwest. You doubtless remember he took the position that this sort of work had no place in dentistry; that artificial dentistry had no more place in the practice of the true dentist than the manufacture of wooden legs had in the practice of the surgeon. What have we had to-day? We have had the prosthetic department magnified until the real object of dentistry, the preservation of natural teeth, is driven into the third year and the student has no knowledge of it until then. Is it not a revolution? Is it not a step backward? Personally my idea is this, that conservative dentistry is true dentistry and the other follows. It appears to me that we have not had the other department presented. My idea is that as soon as we can consistently, freshmen students should be inducted into the mysteries of operative technics and the work should be carried on accordingly. I do not wish to lay any strictures upon the method presented by Dr. Hoff, because schools are driven into these special methods for want of clinical material many times and it fills a void, but in a large city, if a school is properly conducted, there is no lack of clinical material; therefore, a freshman student should be trained upon the tissues of the teeth, upon which he wants to make his living. I throw out this idea because the subject of prosthetic technics is under discussion. As I have previously remarked, my idea of a proper course of instruction to give to a dental student is to induct him into the department of operative dentistry as soon as possible. I would not put him to operate on patients the first year, but I think I would do so the second year.

Dr. George H. Wilson, of Cleveland, O.: I have enjoyed the paper of Dr. Hoff very much indeed. In it he has emphasized the work done in the prosthetic department. It is only a few years

since this department was a less distinct part of our profession. It seems to me it is the foundation or the key to the whole situation in that we have to deal with the mechanics of dentistry. If we have not great mechanical skill we cannot be good dentists. This paper shows with what enthusiasm prosthetic dentistry is taken up. Whatever department is taken up before any school, let it be pursued enthusiastically, and then we will make a success of it. Most of us have systems of our own for teaching the different departments of dentistry, and yet I think when we come to compare them some of us will go home and change our methods, because we will see others who have systematized their work much better than we have. When we come to have a report from the departments of dentistry in the various schools we will see a great difference. For instance, one school will devote eight hundred hours during the whole time to prosthetic dentistry, while another school devotes seventy hours. Another school spends two hours a week in this work for twenty-two weeks, and this is done in the evening. I do not consider it technic work at all. The men here to-day are thoroughly familiar with technic work, and I think when all of the schools report we will have some reliable and practical system to work on. I am glad for one that this subject has been brought up. We might have a syllabus formulated and sent to every school, suggesting a minimum desirable course, so that schools that do not comprehend what technic means may be educated in this line. We are here for the purpose of teaching ourselves and the whole profession. In the school I represent we devote nearly six hundred hours to the work described, so that we get more done than the school which only devotes ninety hours to it. What I wish is that we might have other models instead of having duplicates of the same class of work from beginning to end, so that when we look at the box we can see a system from beginning to end. It is true we have here some beautiful displays of work, but there are many duplicates of the same things.

Dr. H. Carlton, of San Francisco: I am very much pleased with Dr. Hoff's presentation of this subject, and we should not lose sight of the fact that he has simply presented the prosthetic technic side of his college work, and that he has presented simply one-half of the day's work, and that operative technic is given just as much weight and importance as other subjects. He is by no means allowing the study of tooth tissue to be forced into the background as Dr. Smith seems to think. Dr. Hoff has advanced some excellent ideas; I took notes as he was reading his paper, and I propose to put them to practical use in the teaching of operative technics.

Dr. George Field, of Detroit: We are a body of teachers representing different schools and we are expected to find fault with one another. I have very little to add, except to take issue with Dr. Hoff regarding one expression that he made use of, and that is a suction chamber. If he had said relief chamber, I would agree with him.

Reference was made in regard to requiring students to take impressions from the dummy. I do not think it is good teaching because any one who has practiced dentistry for a number of years knows that in nine cases out of ten, if they use modeling compound, wax, or plaster of paris, there are certain difficulties that they will have to contend with. In taking impressions with wax or modeling compound, there will be a change brought about by removing the impressions from the mouth by the suction or atmospheric pressure, which accompanies the modeling compound or wax, the wax getting out of its proper shape in removing it from the mouth. In taking an impression with plaster from dummies, when Dr. Hoff uses that term he does not teach students how to take an impression because the dummy is so rigid it will not press away the soft tissue of the mouth as an artificial denture will do when it is placed in the mouth; consequently it takes a man of some ability and skill and experience to know just exactly how this should be corrected. The student should be taught how to carve, to take an impression of the mouth he is going to work upon, and find out what tissues will yield and what tissues will not give under pressure, in order that the cast may be cut down and carved to represent as near as possible the condition that will take place after the denture is made and worn in the mouth. Let us take, for instance, a plaster impression from the dummy and make a plate from that; it will fit your dummy, but it will not fit the mouth in nine cases out of ten that it is put in to fit. I do not think it is good teaching to instruct students to take impressions from models outside of the mouth. I think that an impression model should be made from the mouth; that the student should be taught where the carving should take place, and why carving should be done. We are here to learn something as teachers in order that we may be able to teach others.

[This idea should be brought out in its proper place, namely, the prosthetic lecture and clinic. The object of a technique course is not to teach adaptation, but to develop manual skill and methods of construction. N. S. H.]

Dr. Thomas E. Weeks, of Minneapolis: I am afraid some of the gentlemen lose sight of the fact that technic teaching has for its

basis the idea of taking raw material and making something of it by successive steps. The object of taking an impression of an inanimate object is almost solely to familiarize the student with the material that he has to use. It is to teach him to manipulate the material first.

The object of these meetings is to compare methods and find out which method will give the best results in the shortest space of time. We are all crowded for time; all colleges have not eight hundred or six hundred hours to devote to this work. We have to bear in mind that students have to learn other things as well as technics and the manipulation of material. The principal point is to train the eye, mind and hand at the same time, and it is by a series of evolutionary steps that we expect the student to make a finished dentist, and it is our province to do all we can as teachers to select those methods which will accomplish the best results. By presenting our different courses and comparing them we can go home and revise them, so that they will fit our individual needs and fit the general needs of the student. If the gentlemen will bear this in mind all the time, they will not criticise manipulation of our materials on inanimate objects first. Dr. Hoff makes the point well: we teach technic first and its application second. That is the plan as I understand it.

Dr. W. Crenshaw, of Atlanta, Ga.: Our students begin by taking an impression with wax and follow that up with modeling compound. We divide our classes into sections in equal parts of the room. Before taking any impressions one of the teachers ascends the platform and describes in detail the preparation of the material in full view of the class, so that each student can see and hear every detail. We spend two hours a day, from 10:30 A. M. to 12:30 in making impressions with wax or modeling compound. The students line up and take impressions of one another's mouths. Occasionally one gets a sore mouth. Each impression is submitted to the demonstrator for criticism. If not perfect it is taken out of the cup, broken, and sent back. We require students to secure an accurate impression of the upper and lower jaw with modeling compound first. These models are laid aside and we follow that with plaster. They soon become familiar with using plaster in making models. The first impression they take with plaster is of their own mouths. We require this so that students may know the way it feels in getting it out. We follow the same routine, requiring upper and lower impressions, making accurate models from them. We now have two upper and two lower models, one each from modeling compound,

and plaster, for comparison. We use the first models, those from the modeling compound, for partial plates. In the upper plate the anterior teeth set close to the gum, and when finished a couple of teeth are removed from the upper plate giving two forms of repair. Following that we make a full set on the plaster models. We always guarantee to make an upper and lower set of teeth for any one, and our students living in boarding houses circulate this matter. We have no trouble every year in getting plenty of patients for taking impressions where there are no teeth. One patient, an old man, we have had for five years. After the students have made impressions where there are teeth, they cut the teeth off and carve out, according to their idea, a model of the upper and lower jaw. They carve the upper to represent a mouth where the anterior and posterior teeth have been extracted for a long time. In the lower they follow the same plan. I should say that they carve the upper first. The upper teeth are cut from the model, leaving the lower intact. They select the upper set first so as to occlude with the natural lower teeth. It gives students the idea of arranging the upper with the lower in the individual mouth; then cutting the lower off they arrange an artificial lower to the upper.

In the last four weeks of our course we teach orthodontia technics, giving our students instruction in the Jackson system, the Kirk system, bending wires and soft solder and finishing them up. So far as I can see, our course does not differ materially from those described.

Dr. J. Q. Byram, of Indianapolis: It seems to me, in teaching technics, that operative technique should come first. The student should first be familiar with dental anatomy, then he will move easily to learn prosthetic technic. Then it will not be altogether mechanical. He has the knowledge he has gained from operative work which will assist him materially in this work. In our school we begin with operative technique and carry it out for four months, fifteen hours a week; and at the close of this work we take up prosthetic technic. We have a dummy articulator for every upper and lower; the student takes an impression in modeling compound for the upper, and in plaster for the lower. He constructs his models, makes his base plates, articulates his case, and goes ahead as though it was made from the mouth. After that has been done he takes another impression of the upper, places the lower on the articulator, obtains his bite, and then he makes a block section of the upper teeth. After having done this he makes a partial plate. Then we devote probably three weeks, if all taken together, to

making crowns. We combine crown work with plate work, because there are times when we have thirty minutes or an hour when it is not best to to take up a new operation.

In the junior year we take up metal plate technic, because the professor of prosthetic dentistry begins his lectures on that subject in the junior year. He lectures on dies and counter-dies. The student takes up technic work with the lectures on aluminum. We take up the subject of aluminum and follow the professor. In this way the student remembers the work so much better. It is more systematic, and does not crowd the students so much in the first year. Our juniors do porcelain face crown work and our seniors do continuous gum work, orthodontia and bridge work.

Dr. A. J. Goslee, of Chicago: I have enjoyed very much the paper read by our worthy colaborer, Dr. Hoff, and inasmuch as our work differs slightly from his, I have thought it advisable to give an outline of the technic work as taught in the Chicago College of Dental Surgery. We have congratulated ourselves on teaching a good course in prosthetic technics, and we accomplish excellent results. The technic work of the freshman year is carried on in the afternoon from 1 until 4. At the beginning of the freshman term the class is divided into two sections, one pursuing the course of prosthetic technics, the other that of operative technics, those going into one section remain there until the middle of the term. Then they alternate, and the other takes the opposite course for the remaining portion of the term. In the freshman technic work, prosthetic, students are taught to take impressions with various materials, similar to those outlined by Dr. Hoff. If we only had some syllabus to go by in prosthetic technics, as outlined to us by Dr. Hoff, as we have in the operative line, we could accomplish much better results. We would have something to guide us. As it is, we have to teach our own ideas, based exclusively upon our own personal experience. It is hardly necessary to dwell upon the technics of the freshman year because they are similar to those outlined, including a full upper denture upon brass and soldered rims, making a fusible alloy plate, commonly called a Watt's metal plate. We have devoted the entire afternoon for three months to this particular work, and at the same time the student has been receiving lectures on dental anatomy and other collateral subjects, so that he is not working entirely in the dark. He receives three lectures every morning of an hour each, thus enabling him to give his entire afternoon to technic work. Dissecting is done in the junior year. At the beginning of the junior year the lectures are arranged simi-

lar to those outlined, except that they may be later in the afternoon, say from 5 to 6. This does not interfere with technic work. We begin upon crown and bridge technique. We first require the student to carve out of plaster or whatever material is used, an exact reproduction of a bicuspid or molar tooth, the idea of this being to familiarize him with the external form of the tooth. He may study theoretically its anatomy, but we want the form of the tooth and especially its crown. After having made this, we then put the students upon the preparation of roots for the reception of bands. They make and fit to each root of the bicuspid and molar two bands, giving to them an artificial festoon. Around one of those bands they shape, as it should be, the occlusal edge of the band, representing as nearly as possible a cross-section of the teeth which marks the dividing line between the cusp and band. They familiarize themselves with contouring. They are instructed to shape a band to resemble as near as possible the form of the tooth and restore the points of contact. They familiarize themselves with the shaping of the band itself. After having completed this they are next put upon metal crowns. We require two bicuspids and two molars, one with swaged cusp, the other with solid cusp, using either silver or copper for casting the solid cusps. Copper is more difficult to manipulate, but a little less expensive. We leave that optional with students. After having made these crowns, with bands properly trimmed and contoured, they are filled with plaster. Out of this plaster is trimmed a typical cusp, representing the crown of the tooth that they are working upon. For the purpose of trimming up those cusps, I have prepared a set of models, as you will see by these, to be used as guides for them to go by. An impression of this is taken in modeling compound and a plaster of paris reproduction of it is made. Each student has an exact reproduction of this model for his own use throughout the course. After having secured a set of models, which he can place in front of him, they guide him in placing typical pits and grooves and the cusps as they should be. Having made four crowns, putting the teeth in proper occlusion, he is required to follow the same ideas exactly in crowns made upon models; they are made to articulate with opposing teeth. He takes an impression of his own mouth or that of his associate and prepares the root for a certain tooth; whether it be a second bicuspid or first molar, it does not matter. Placing the root in the proper place in the impression, he fills it and makes of it articulating models, so that he can separate them and place them back in their exact relation. He selects the opposing

tooth and fills it with plaster. Then he instructed to trim a typical cusp without interfering with the points that may mark the pits of the opposing tooth. After he has made a crown upon models, he is then put upon porcelain face work. The first thing he does in that line is to back up facings and make various kinds of porcelain face crowns. I will say, however, the student is required to make twelve different crowns altogether. This work takes him up to about the holidays, after which he is required to make a bridge in the same manner. I will say in this respect that there is no die-plate used. In the Chicago College of Dental Surgery we make special dies for individual cases. It is not only the way to teach accuracy of adaptation, but it gives students the idea of cultivating the fingers and hand manipulation. We must teach students finger and hand movement; they must become thoroughly familiar with the form of the tooth itself, its crown and cusp. After having carried out the work required to make a bridge of five or more teeth, and made in the same manner exactly, they are required to make a partial swaged plate for various kinds of teeth, gum and plain, in various portions of the mouth and solder the attachments. All the teeth and cusps are attached by means of solder. We have no rubber work at all in the junior year. Having finished this work, it carries them along to about the first of February, when they devote at least a month to orthodontia in relation to technic work, which will consist of materials, as wires, tubing, making taps, nuts and drills, but they do not attempt to construct in any way appliances. It is simply the making of materials that they begin with. The course in prosthetics carries the student up to the end of the junior year, when they are given the first opportunity they have for working in the infirmary, doing practical work in the mouths of patients. If they do not finish the technic work in time to get the infirmary they are not permitted to do that.

One little point more. Dr. Hoff said in his paper that he found it advantageous to keep all students working on the same thing at the same time. I quite agree with him. We can get better results by having all work on a piece of work at the same time. It is not only easier for the teacher but for the students, because, as he has told us, they get ideas from each other which materially facilitate the work.

Dr. S. H. Guilford, of Philadelphia: I have been getting a great deal of good from the remarks of the various speakers this afternoon, and yet there is not one speaker with whom I can fully agree. On the other hand, not a gentleman has spoken but what I

have received from him some valuable information. I think we have had represented certain extremes. For instance, as far as the outline given by Dr. Hoff goes, it is excellent, but it goes a little too far. It would not suit the purpose of the students I have to teach. On the other hand, we have had other extremes. I know of a dental school that two years ago allowed its students to operate upon patients immediately after the Chrismas holidays of the first year, which was perfectly barbarous. However, they did it, because they had a superabundance of patients and because they wanted students to have an opportunity of working for these patients, and possibly the students helped their preceptors when they went home at the end of the year. In that case they had too many patients, and Dr. Hoff has too few. We have not sufficient time at our disposal to give our methods in detail. I will only touch upon a few points wherein we differ. The first thing we do with a student, when sent to a dental laboratory, is to place him in the hands of the demonstrator. He is taught the forms of the teeth. He has a great box full of extracted teeth. The teacher takes each student individually and teaches them the different forms of teeth by handling them, until the student is able to distinguish a molar from a bicuspid, a bicuspid from an incisor and other teeth in the mouth. When a tooth is named he is asked to pick it out. He is taught dental anatomy in the beginning; he is taught what a human tooth is like. This part we include with operative technics. After this we make sections of the teeth in order to study the tissues and the internal as well as the external anatomy. Having done that we put students immediately upon prosthetic work. We teach them, first of all, to take impressions in wax, in modeling compositions, etc. Here is where we differ from some other schools. One gentleman says that the proper way for a student to take an impression is to take it in the mouth, because they encounter difficulties that are not met with otherwise. Others think it is better to use the dummy. We think the best thing is to take an impression from the student's mouth or that of his companion, or model. He does not take an impression of the mouth until the middle of the junior year; a student is not allowed to touch a patient until the middle of the junior year. We think that if he did so earlier than that he would be incompetent to do it properly, and that if he did it later we would be retarding him in his progress.

In regard to the regular work of the first year—prosthetic technics, our course is very much like that described, taking impressions, making models. After that, making dies and counter-

dies, vulcanite plates, etc. Later in the session he is allowed to make dies and counter-dies, to swage plates, to select and grind teeth and attach them by means of vulcanite to the plate. When our students have done this work and all that I have told you, we consider it evidence that they understand prosthetic work sufficiently to advance to the second year's course. In the second year they carry this work forward, make partial plates with two or more teeth on them, etc., until they complete the second year. They swage metal plates, take the bite in the usual way, and get the articulation. They are required to grind up a single gum tooth upon this model. After the plate has been rimmed, the solder put on, the tooth is put back in the usual way, and plates soldered. An important point is for the student to know when he has got enough solder on and not too much, and that none of the teeth are cracked. When a student knows how to swage a plate and how to back and solder a tooth properly, we are convinced that he has properly finished his prosthetic course.

In the senior year the student takes a living patient and makes a plate in the presence of the teacher or demonstrator and submits it for approval.

In regard to operative work, that is taken up right after prosthetic work has been well under way. At the close of the freshman year we let the student begin with operative technics. In beginning this work he opens pulp canals, puts in fillings in the beginning of the junior year. By Christmas time he is allowed to handle a patient; in the second half of the junior year he is allowed to work in the infirmary with senior students. The junior year is the hardest year; the freshman year is the easiest year. In the junior year the student has not only operative technics to take up, but crown and bridge work, as well as porcelain work.

In regard to crown and bridge work, we have a method of teaching it which differs from that mentioned in some particulars. Throughout the entire junior year, two mornings a week we devote our time to giving a quiz to the juniors and seniors. Seniors are supposed to have finished that work. We give them demonstrations two hours a week. I have a table with the tools arranged in proper form, placed in the amphitheatre. The students all congregate in their regular seats. I have a regular assistant and one other assistant; I go before the class Wednesday and Saturday morning at eight o'clock, and for one hour I not only explain the principles of crown and bridge work, but I do every part of the work before the class. For several years I did it entirely alone. I do it just as I

would do it in the mouth, except that I use brass instead of gold. I find students in the back seats do not see well, so I have had my assistant make plaster models with crowns as large as my two fists, so that the students could see the work that was being done and follow the demonstrations. My assistant makes the bands and solders them, and the students could see what he was doing. After each one of the demonstrations the students go into the laboratory to their individual benches and follow out the same work. In the class room we lay down the principles of the work to be done, and students go from the class-room with a distinct idea of what to do, and when they get into the laboratory the work of the demonstrator is lightened materially.

Another thing. In the junior year, in the course in porcelain work, students are taught the different parts of porcelain work. You are familiar with them. We begin teaching the character of the materials they are to use and how to use them in making crowns and porcelain fillings, and so on.

In regard to orthodontia work we reserve that until the third year, because the junior year has so much in it that students have not the time for orthodontia. In the third year students receive morning clinics in orthodontia work. In the infirmary they receive practical cases. The reason we make our freshman year comparatively easy is because we do not consider that the student has gotten into the harness as yet. During the senior year students devote themselves to patients. We find that it requires quite frequently a year and a half in the infirmary before a student is capable of doing good work upon the living patient.

Dr. J. H. Prothero, of Chicago: First, I wish to thank Dr. Hoff for the very able paper he has givon us this afternoon. It contains some goods ideas, and while we may differ with him in some particulars it is nevertheless an excellent contribution.

We require students to furnish ten upper and lower models in plaster. We put them to work taking impressions in modeling compound, first of each other's mouths. These impressions are submitted to us and passed upon if sufficiently well taken. Usually a student has to take forty impressions before he gets ten upper and lower models. By that time we require him to take two upper and two lower models, taken from plaster impressions and so on. By the time he has taken forty or fifty impressions with modeling compound he learns to manipulate in the mouth. He learns that it is flexible material; he learns how to handle it, and we are teaching him methods he will have to follow in practice.

Among the other lines of work, I think our course does not differ materially from that outlined in the various methods mentioned. We teach carving of cusps in plaster. There is no use of enumerating the details with the exception of those points wherein we differ. Towards the latter end of the freshman year we teach orthodontia work, the making of taps and drills, drawing of wire, making banding materials and one or two forms of appliances, using the angle system to a great extent. In a general way we adhere to that. We make jackscrews. This is begun in the freshman year. Special attention is paid to carving in wax and the teaching of carved plates for vulcanization.

To-morrow I will have some examples of freshman work to show you the results of teaching carving to freshmen. You will then be able to see for yourselves what freshmen can do in this line of work.

Dr. G. V. I. Brown, of Duluth, Minn.: I found some years ago the same difficulty Dr. Hoff mentioned in regard to students not seeing the work as it is being demonstrated, and when I was doing this work I used large models of clay and plaster. Instead of using brass as suggested, I used sheet brass of about the sixteenth of an inch thickness, which was easily manipulated before the class without the aid of any particular instrument and fastened with soft solder. Then I had duplicates made of small pieces, as Dr. Hoff has shown you, which could be shown afterwards in order to clear up any misconception that might occur of the different materials on account of their size.

Dr. W. J. Brady, of Kansas City, Mo.: I have something to give you that is new, I believe, if there is not a representative of the school here from which it comes to give it himself. I would like to know if the Royal College of Toronto is represented.

The President: I do not think it is.

Dr. Brady: They sent to me a synopsis of their outline of work in prosthetic technics, and it seemed a novel idea to me. It is this: The author has marked upon a sheet of paper (printed) exactly the point at which he must submit it to the demonstrator. A rubber plate is arranged in the articulator with teeth properly arranged with half of the flask ready to invest, and when completely flasked and invested ready to have the rubber packed therein. A card is furnished to every student on which there are certain numbers to be punched at the particular steps shown. In this way every student's work is seen, and he is kept from going wrong at certain points where he is likely to make mistakes. I give you this as something that is brand new.

Dr. A. E. Webster, of Toronto: I have been an assistant in the Royal College of Toronto for three or four years, and I wish to say that we have used the method for two years which Dr. Brady has just presented. The work is laid out before the year begins in the printed pamphlet. Each student has one of his own, and knows when he takes up the work it is to be completed at a certain date. No extension of time is allowed except in cases of illness, so that every student is compelled to work at the same time that other students work. Each piece of work is presented as Dr. Brady has described to the demonstrator in charge. By following this method one can easily determine how much a student knows when his work is completed. It has the advantage of keeping them together. There are other points that could be mentioned, but not being present in the college for the last two or three months I do not remember the details. I do not teach that department.

Dr. D. M. Cattell, of Chicago: Just a few words in regard to this subject. I shall have to beg your pardon once more. Do not get things mixed. We are talking on prosthetic technics, *laboratory work*, not infirmary procedures. It is the technique of the *laboratory*, We call ourselves technic instructors, we teach technic classes. It is not senior work, and not infirmary work at all. We are dealing with the principles and methods involved in teaching prosthetic technique, not the time we do it, whether it be the first or second year. The time of the session or part of the session when such and such work should come in is not under discussion now. Again, we are technic instructors, whether it be operative or prosthetic. We have no rubber plates; we have rubber in the laboratory that we vulcanize; the result is vulcanite. We do not have rubber teeth; they are porcelain teeth. We do not even make Richmond crowns. Richmond has no crowns; he never had one belonging to his name. We make porcelain faced or shell crowns, if you please. As we are technic teachers let us be careful of the terms we use and not use terms that many students, if they heard us to-day, would laugh at, because they are wide awake; they have dictionaries at home, and in using old terms let us as teachers be careful, or we will get laughed at.

Two or three years ago we got Professor Hoff interested in technic work. At first, he could not see very much in it. To-day, where is he to be found? What has he done towards presenting a method of technic instruction in prosthesis? He is full of it. He has read the grandest paper we have ever had on the subject. Dr. Weeks, Dr. Morgan and two or three others prayed with the man to convert him to our ideas of technic teaching.

Dr. G. V. Black, of Chicago: I must say, I am very glad to have listened to this discussion. It has been interesting to me as showing the development that is taking place. It illustrates what we can do, what we will do. Of course, this matter of teaching technics is comparatively new and our methods will be different; our ideas will be different, but I wish to say that of the several plans each cannot be the best. In discussing the subject in this way and illustrating the results we get closer and closer together; we are picking up the better points and adopting them continually, perhaps not always. It is not always that each man gets hold of the best point and adopts it. But we are getting hold of points, and as we do so we are getting closer and closer together. As we do this we are certainly progressing. Some one has said that we are picking up raw material to see what we can do with it. That is correct as far as these materials go, but they are only a means to an end. We are taking up the raw material to see what we can do with it, and that raw material is boys, not brass, not plaster, and so forth. These are the only means of developing boys, making them artisans preparatory to making artists of them. And this is to be followed by the professional man. These materials are only a means of developing students and making something of them. That fact must not be lost sight of for a moment.

This is about all I think I have to say, except to express my gratitude that this work is progressing. A better method would be to have each of our pupils to take a course of study and reading with a preceptor, but that is impracticable as we all know; hence we must adopt other means, and I am heartily glad that the subject has been presented so well.

Dr. Hoff (closing the discussion): Some have criticised the time we spend in this kind of work at Ann Arbor. We do not have as much clinical material for practical prosthetic work as you do in some of your schools, and we have to make up in this direction by some such work as I have outlined here to-day. But I want to say that in my judgment I should not curtail this department without it was absolutely necessary to accommodate other work, even should we have a great abundance of clinical material at command. Because of the value and importance of it as a preliminary manual training. In operative dentistry in all directions we have as large a clinic as any of you. If you come to Ann Arbor we will show it to you. To give you an idea of the magnitude of our work, I will say that we made over six thousand gold fillings in our clinic in nine months, all done by senior students.

Dr. Guilford: How many students are there in the class?

Dr. Hoff: There were fifty-six. This year we have about the same number. We have sixty chairs in our operating room, and all of them are as a rule, after the first of January, filled every afternoon. You may wonder how we get this clinic. We get it from the students in the University. Our department is on the campus where we can draw these students in. We get the advantage of these students, and they come to the college to have their work done. Then, too, we have a rich county; and we draw from it and the city of 12,000 people. In respect to operative clinics we are not at all behind; but we do have a lack of material in the prosthetic or plate line, so that we do not have a great deal of plate work. By concentrating the practical work in a single year when the student is at his best, that is the third year, we accomplish more in a shorter time, and bring all the artistic and practical work together in a single year.

There were many things said this afternoon upon which I should like to speak, but time is too short. There is one thing I have been thinking about since I have been sitting here, and one thing that I want to say more than anything else; it is that we should have more uniformity in our method of imparting instruction in Mechanical Technique; we need to get together on this subject. We do not need a text-book; we do need some kind of outline, and I have threatened for three or four years to get up something of this kind for my own use, and personally I shall be glad to have a committee appointed by this Association to formulate for us a system of prosthetic technics, and, if possible, issue a syllabus, or system of charts or models, or whatever may be necessary to enable us to teach our subject systematically and with facility, so that we can get the most work done in the shortest time. If we have more time and better facilities we could do more thorough work. I do not think there is anything as important as this one point. I do not want to issue a text-book, as nobody else would use it. If we could get together and issue a syllabus that would embrace all of our ideas, outlining a course, and have printed in it reference to our text-books where students could be directed to look up a certain appliance that is given to them to make, it would be a great step in advance.

The greatest drawback I have found in teaching this work is in giving demonstrations. I have resorted to expedients to present it in the shortest time. It is difficult to keep the attention of ninety students for an hour or half an hour in giving a demonstration. A

student sitting at a distance thinks of something he wants to tell his neighbor, and soon there is a buzz going all around the class, particularly if you do not have something of special interest. I want something to overcome this lack of attention. I have thought of preparing charts which would illustrate what I am doing, and which would claim attention. Then give students note-books and colored lead pencils and compel them to draw what they see, and they could listen to what you would be able to say while working. Thus they would pay closer attention to the work, and study the charts more carefully than they would by simply referring to them. I have thought of that idea, and it is one I shall put into use in connection with this work. If any of you have a better one, I should like to know it. The plan of dividing classes into smaller sections is a good one, but it increases the burden of a teacher's work, and is likely to make it less efficient because of the necessary repetitions.

Instrument Nomenclature With Reference to Instrumentation.

By G. V. Black, M.D., D.D.S., Sc.D.

INTRODUCTION.

The want of some recognized scheme of Nomenclature and Classification of Dental Operating Instruments that will individualize the instruments of the several orders and classes is a great bar to progress in teaching instrumentation. This is apparently severely felt by all who labor for exactness in their operations, or endeavor to express the manner of their performance and to speak of the instruments used. The teacher has no means of telling his pupils just what particular instrument he would use in performing a specific act in excavating a given cavity or preparing a margin. The only means of individualizing excavators and pluggers, the instruments which present the most important variations, has been the manufacturer's number. These numbers have not been used by the profession, except occasionally for ordering instruments from catalogues. An extended study of these numbers develops the following facts: When an instrument is designed that is thought to be a good pattern the manufacturer assigns it a number. The pattern is preserved as a guide to the reproduction of the form and each instrument produced is stamped with its number. In this way hundreds of instruments are numbered without system. Finally, to rid himself of the multitude of instruments and numbers, the manufacturer

collates those forms that sell best and throws out the rest. He then renumbers those retained, and enters them in the new catalogue. In this way instruments of similar pattern are for a time brought nearer together in the numbering. But the process of adding new numbers begins again and soon it becomes another confused mass. There has never been any system of numbering that indicated either the form or use of the individual instrument. It has been purely arbitrary. For this reason, the numbers have not been used by teachers, except for the one purpose of making lists from which the students should do their buying.

A dentist needs some means of indicating precisely the forms of the instruments used in the operations he endeavors to describe, and especially is this badly needed in school work. So long as the teacher has no means of accurately designating the particular instrument he employs, so long will his manipulative teaching be vague and uncertain. The pupil will be unable to know just what is meant, and any description of the manner of using individual instruments will be confusing and without force.

Not only this, but the confusion gives rise to an unnecessarily great multiplicity of instrument forms. We being unable to teach manipulation, the student fails to learn the range of valuable instrument forms, and the powers and capabilities of instruments, and is therefore continually seeking new forms, hoping to find that which will serve him better. This being done without accurate appreciation of mechanical laws, the vast majority of efforts are failures, which tend only to further confuse the manufacturer's numbers.

It should be regarded as a truism that the really capable instruments are strictly limited in present modes of operating by definite laws of usefulness that no man can put aside, and that the valuable forms continue in our cases year after year.

Spececial instruments for special purposes there are, and many of them fitted only for individual idiosyncracies in operating. Radically new instruments of value in the line of excavators and pluggers come forward now-a days only as modes of operating are so changed as to require new forms. This kind of growth will continue. That which is needed now in the line of excavators and pluggers is a strict classification of the useful forms and the development of a scheme of nomenclature for the individual designation of each form. The presetation of such a scheme to the pupil will place before his mind the range of possible forms from the mechanical standpoint, and will enable him to know quickly what has been produced, and in a much fuller sense than heretofore to know what can be produced.

This failure to appreciate instruments forms and the special usefulness of each form gives rise to great confusion in operative procedure. The disagreement as to method among dentists is unnecessarily great, and when such a degree of confusion exists only a very few of the methods can be the best. We should be able to teach methods in our schools. Can we do so without the ability to designate accurately the means of carrying out the method? The carpenter would not buy an auger that had not been made to a definite formula. The carpenter's boy would be laughed at, if, when sent for a quarter-inch auger, he should bring a seven-eighths. Can we not appreciate the forms and sizes of our instruments as definitely?

What our students need in the beginning of school work is a close drill in the appreciation of the forms of cutting instruments and pluggers, such as will enable them to discover the peculiarities of each with exactness, as to width, length and inclination of blades, and the proportions of the several parts. Also they should be instructed as to the possible variation of useful forms. Directly coupled with this, the student should be taught to record the forms for future reference; and, it would be well for him to acquire the skill to reproduce them from the record. If this be coupled with a careful drill in the uses and capabilities of instruments, an impression will be made on the mind, and a skill acquired by the hand that will be a great aid in the development of manipulative ability.

It is my object to develop the details of a scheme of instrument nomenclature and classification applicable to cutting instruments and pluggers, by the use of which the teacher can reach exactness in teaching instrumentation. This will be attained by first defining and arranging in an orderly way the words of instrument nomenclature that have been developed in the ordinary speech of the profession, by use of which groups of instruments may be definitely known; and then arranging a simple system of formulæ by which individual instruments of each group may be accurately designated.

It cannot be expected that this proposed scheme for the classification and study of instruments will be of special benefit to dentists now in practice. That is not its object. It is intended for school work only; but may in time spread to the general profession through the students who go out from our schools.

Another object of the scheme is to limit the number of forms of instruments employed, and to adopt a classified list for school work that shall be sufficient for all schools and not be cumbersome

to any. This can be done by selecting a sufficient classified list to be used in teaching, and from which each school may select the particular instrument the student will be required to have. This particular feature of the scheme will be more fully developed later. Or, instead of selecting a sufficient classified list for all schools to select from, each school may select its own classified list in accordance with a specified set of rules for the arrangement of instrument sets. A plan for doing this will be developed later, by which any classified set of instruments will be perfectly comprehended in the minutest detail from the written statement by any one familiar with the scheme of classification, and who has attained a working knowledge of any single set of instruments so classified. Also, such instrument sets may be accurately made by any skillful instrument maker without other guide than the written formulæ and the rules that will be developed in this paper.

This paper will be in two parts. The first part will consider and arrange the nomenclature heretofore developed, and the second part will be devoted to the considerasion of formulæ names and the formation of instrument sets.

PART FIRST.*

INSTRUMENT NOMENCLATURE.

[Furnishing the Basis for School Instruction.]

In the development of any system of nomenclature, the basis should be the names that have arisen in the common speech of the profession. These names have a meaning, and, if we gain an understanding of this meaning, we will be able to classify the names in accordance with it, and in so doing present an orderly nomenclature. In doing this it is often necessary to choose between two or more names that have been applied to the same thing and occasionally to separate two items that have been called by the same name. In this way the uncertain numenclature in vogue, developed at random in the first instance, is rendered orderly and definite. This is readily done in instrument nomenclature, and without the introduction of any considerable number of new terms.

Cutting Instruments, or Excavators.—Each excavator is composed of a shaft which is used as a handle, a shank and a blade. Usually in excavators the shaft is perfectly straight and without

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*Some portions of this was given the National School of Dental Technics at Asbury Park in 1895 by Dr. D. M. Cattell, but it is thought best to give it here complete.

variation in size. The *shank* begins with the first turned part and connects the shaft with the *blade* or working point. It usually tapers from its connection with the shaft to where the blade begins.

The *blade* is the part bearing the cutting edge. It may be said to begin at the angle which terminates the shank—the last one, if there be more than one angle—and ends in a cutting edge.

Pluggers have no cutting edges and therefore no blades, as "A blade is the leaf-like portion of an instrument bearing the cutting edge." The shank of pluggers, therefore, extends to the working point, though they may have similar angles to the excavators. (We should have a specific name for that portion of the plugger corresponding with the blade of the excavator.)

CLASSIFICATION OF NAMES OF OPERATING INSTRUMENTS.

Existing names of operating instruments may be divided into Order names, sub-order names, class names and sub-class names (4).

An *Order name* is one designating such instruments as are used for a purpose so similar that groups have received a name indicating the purpose of their use, or answers to the question, "What for?"

The well defined order names are *excavators, pluggers, separators, scalers, finishing instruments* and *accessories.*

A *Sub order name* is one designating the locality, position or manner of use, in such a way as to distinguish certain instruments from other members of the order, or answers the question, "Where, or how used."

A *Sub-order name* is often attached as a prefix to the order name, as *hand* plugger, *mallet* plugger, *push* scaler, *pull* scaler, etc. *Enamel Trimmer* is a sub-order of excavators. *Burs* belong both to Excavators and Finishing Instruments as sub-orders, as *cavity* bur, *finishing* bur. The word *Bur* is properly a class name—they have no order name.

A *Class name* is applied to a group of the members of an order and describes the point or immediate working part, as *hatchet* or *hoe*, descriptive of the blades of excavators, or the working point of pluggers, as *convex* plugger, *serrated* plugger, *smooth* plugger, etc.

A *Sub-class name* describes the angles and curves of the shank leading to the working point or blade, as *bayonet* plugger, *spiral* plugger, *contra angle* hatchet excavator.

In the common speech of the profession, these names have been habitually compounded. Sub-order names are prefixed to order names—as in mallet-plugger, hand-plugger, etc. Class names are prefixed to order names, as in *hatchet* excavator, *spoon* excavator,

hoe excavator, etc. Also sub class names may be prefixed to either order or class names, or all these joined, as in *contra angle hatchet excavator*, or in *bayonet plugger*.

In all these compoundings, the order name is last, indicating the use or purpose—the sub-order name prefixed, indicating how or where, while the class name is descriptive of the forms of the working point, and the sub-class name the form of the angles and curves of the shank leading to the point It should be noted particularly that these terms are applied to groups of operating instruments. They specify the kind of instrument but do not individualize the instruments of the group. These may vary indefinitely in the widths, lengths and angles of blades. For these differences we will propose other terms.

RIGHTS AND LEFTS.

There is a distinct division in operating instruments, known as *Rights and Lefts*. Among excavators we have two forms of rights and lefts. The *beveled* rights and lefts and the *lateral cutting* rights and lefts, or, true double plane instruments. The beveled rights and lefts are hatchet forms made rights and lefts simply by the form of the bevel of the cutting edge. Most of the hatchet forms have bi-beveled edges, i. e., the edge is formed by grinding equally from the two flat sides of the blade. The beveled rights and lefts are formed by making two hatchet forms alike, and then grinding the bevel all from one side on the one, and all from the other side of the blade on the other. The result is a pair of instruments, the one suitable for shaving down the buccal wall of a cavity, and the other suitable for shaving down the lingual wall. The cutting edges are upon opposite sides of the blades, maxing them rights and lefts. These are used mostly for cutting enamel in opening cavities, but may also be used very effectively in cutting dentin. Any of the hatchet excavators may be made in pair and converted into beveled rigts and lefts, but the general adoption of this, while producing excellent instruments, multiplies the number of instruments in the operating case to such a degree as to cause confusion. For this reason the formation of beveled rights and lefts should be very strictly limited to enamel instruments, or to special instruments in heavy cutting.

LATERAL CUTTING RIGHTS AND LEFTS.

True Double Plane Instruments.—The double plane, or intersecting plane rights and lefts are a totally different class of instruments, and are designed for lateral cutting, while the other forms,

single plane instruments, are for direct cutting. If any of the single plane instruments be laid upon a table or any plane surface, in a certain position, it will readily be seen that all of the angles and curves, no matter how many, are in a single plane. If it is held before the eye, in a certain position, the instrument appears straight —such instruments are suited for direct cutting.

If we carefully examine the rights and lefts known as spoons or rapid excavators, it will be noted that each has an angle or curve that is not in the same plane with the principal angle or curve, but in a plane that intersects the plane of this principal angle at right angles. These we will call *double plane* instruments—they differ essentially from the single plane instruments in that they are specially suited for lateral cutting. They are always made in pairs. They are first formed similarly to the hatchet excavators, but after the blade is formed the blade of one is curved to the right and the blade of the other is curved to the left. This important division of cutting instruments is confined mostly to what has become known as spoons. They are suited to scooping out masses of carious material. They are not of much value for cutting hard material. This form of rights and lefts is also used occasionally in pluggers.

DEFINITIONS OF CLASS NAMES.

A *Class name* is one that describes the immediate working point of the instrument.

CLASS NAMES OF EXCAVATORS.

Hatchet.—The shank has one or more angles or curves, the last length forming the blade, the edge of which is in the plane of the angle or angles.

Hoe.—The shank has one or more angles, the last length forming the blade, the edge of which is in a plane intersecting at right angles the plane of the angle or angles.

Spoon.—These are always made in pairs. They are first made in the form of hatchets and then the blade of the one is curved to the right and the blade of the other is curved to the left, then the cutting edge is ground to a semi circle. This curve of the blade is in a plane that intersects the plane of the principal angle or angles at right angles, making the instruments true rights and lefts.

Discoids.—(Disc-like, circular). The blade is circular in form, having a cutting edge extending around the whole periphery, except that portion by which it is joined to the shank. This circular blade is placed at more or less of an angle with the shaft.

Formerly this form was called a spoon, several forms being

grouped under that name. Discoid blades are sometimes seen on double plane instruments of various forms.

Cleoids.—(Claw-like—in the form of a claw). Sharp pointed blades in the form of a claw, with cutting edges on two sides of the blade.

Chisels.—Straight blades with cutting edge formed by beveling from one side. The blade is usually straight with the shaft, but may be slightly curved.

Binangle Chisel.—A chisel blade placed at a slight angle with the shaft in the hoe form. They are contra-angled.

Rotary cutting instruments will not be included in this list.

SUB-CLASS NAMES.

A *Sub-class* name is one applied to and descriptive of the angles and curves of the shank of an instrument which leads to the blade or working point.

Mon-Angle.—An instrument having one angle only leading to the working point as in pluggers, or forming the blades as in excavators. Mon-angles form a large majority of excavators. In the greater angles only the shorter blades can be successfully used as mon-angles, for the reason that when the blade is long its inclination carries its working point laterally so far from the central line of the shaft as to render the instrument liable to turn in the hand when the edge is forcibly applied. This renders the instrument unsteady and ineffective. To remedy this defect, all cutting instruments, in which the angle and length of blades will carry the cutting edge more than three millimeters from the line of the central axis of the shaft, should be contra-angled.

Contra Angle.—The shank of the instrument is first bent backward (from the direction of the cutting edge), and nearer the cutting edge another bend is made forward—this length forming the blade, the object being to form a long blade, the edge of which will be near the central line of the shaft.

Binangle Contra Angle.—A contra angle formed by two angles as described under contra angle.

Triple Angle Contra Angle.—In an instrument of the angle of 12 centigrades or less (about 45 degrees)—the binangle contra angle will begin the cutting edge sufficiently near the central line of the shaft, and at the same time carry the shank sufficiently out of the way to permit the use of the full length of the blade; but in instruments of a greater angle, a binangle would not do this, therefore a triple angle must be made; this is done by first

bending the shank backward as in the binangle contra angle and then forming another angle which will bring the remainder of the shank parallel with the shaft; then passing forward a space of more or less length as may be required, another bend is made forward by which the blade is formed. In this way the cutting edge of a long blade is brought sufficiently near the central line of the shaft for effective work, and the shank carried sufficiently out of the way to permit the full use of the length of the blade.

Long blades that require contra-angling are mostly for use in places where a long reach of blade is necessary.

There are a number of other sub-class names that have been applied to excavators, but as none of them will be used they will be passed by for the present. Also, there are a number of sub-class names applied to plugger points, as cork screw, cow's horn, bayonet, etc., but as we shall not fully consider pluggers in this paper, they will also be passed.

Curves occur among the rights and lefts or double plane instruments for which no distinctive names have been developed. Those forms which I designate as spoons have a curve beginning at about one-third the length of the blade and gradually increasing to the cutting edge. Another form often seen, but which now seems to be in less favor, is what I should term the hoe spoon. This blade is straight like that of a hatchet until near the cutting edge, when it is bent laterally at an angle, and the cutting edge rounded as in the spoons. These are in pairs, as the spoons, and are true double plane instruments.

Other forms that have been used are almost endless, many of them without names, and very generally have disappeared under the law of unfitness for the purposes intended.

RULES FOR CONTRA-ANGLING.

RECAPITULATION.

1st. All blades, the angle and length of which will bring the cutting edge more than three millimeters from the central line of the shaft, should be contra-angled.

2nd. All instruments with angles of 12 centigrades or less, when requiring contra-angles should be binangle contra-angles.

3rd. All instruments with angles of more than 12 centigrades, when requiring contra-angles should be triple-angle-contra-angles.

4th. When the contra-angle is used the cutting edge of the instrument should be brought within two millimeters of the central line of the shaft, or better—when the contra-angle is used the work-

ing edge should be brought just so near the central line of shaft that when the instrument is laid edge downward upon a plane surface the edge should just touch, but not actually rest upon the surface.

SECOND PART.

FORMULÆ NAMES.

The names which have thus far been developed are sufficient for the designation and easy recognition of instruments belonging to any order, sub-order, class or sub class. They are not sufficient, however, for the recognition of the individual instruments of any one of these divisions of forms. The blade of a hatchet or hoe excavator may have an angle with its shaft varying from a slight inclination to a quarter of a circle, or even more. Any angle of blade between these may be effective for some particular operation. A similar variation occurs in the widths and in the length of blades. An examination of the excavators on sale in our dental depots shows that the widths of blades vary from two-tenths to fifteen-tenths millimeters. The lengths of blades vary from two to about ten millimeters. Any width or length between those mentioned may be effective in some particular operation.

Now any of the widths may be combined with a great diversity of lengths and these again may be combined with a great diversity of angles. We readily see that in this way we arrive at a vast multitude of slight variations in these instrument forms, and any attempt to specify individual instruments without some rules for limiting the number becomes hopeless.

I took up this matter as a subject of study a number of years ago, with the thought that these instrument forms, or a sufficient number of them, could be specified by formulæ, as is done generally with mechanics' tools; as the quarter-inch auger, half-inch chisel, etc. In this study I was at first led into a very complicated system of measurements, which I considered too complex to introduce into school work. But the need of some available system has been so constantly apparent that the subject has not been allowed to rest. Work has been renewed at intervals with each new thought obtained; and finally the idea of a strict limitation of instrument forms in breadths, lengths, and angles of blades has been arrived at. The carpenter will not buy an auger or a chisel that has not been made to a definite formulæ—a definite measurement. This is true of mechanics' tools generally. They are all made to specified formulæ. It may be said that the mechanic's drills are made to

definite formulæ in order that he may fit bolts made to similar definite formulæ, and that the dentist does not do this. True, but the mechanic also uses these formulæ in naming both his drills and his bolts that he may know them. Why should not the dentist have his instrument made to definite formulæ in order that he may know them, and designate the one fitted for a special act in excavating? Why should he have an infinite variety of forms without definiteness? No one dentist uses such a variety. Why should we not agree upon definite angles of the blades of hatchet and hoe excavators and combine with these angles definite sizes, or widths and lengths of blade? In this way we may gain a sufficient number of forms of cutting instruments and rule out all others. And then the thought has also come to me of arranging these in definite sets in which the formulæ names shall run on definite gradations for all of the instruments of each set, and in this way so construct them that they will be easily learned and remembered by students.

A strict study of the subject from this standpoint develops the fact that we do not need more than three, or at most four angles. Now with each of these three or four angles we will combine one long blade of definite width, one medium length of definite width, and one short blade of definite width, stipulating that the lengths and widths shall be the same in each angle. This makes a set of hatchets—if three angles be used—of nine instruments, and a set of hoes of nine instruments—or eighteen instruments in all. These we may name the set of ordinaries. (See list of formulæ No. 4). With this limitation of widths and lengths and angles of blades, and the regular order in which they occur, the difficulty of learning to know them by formulæ is reduced to a minimum. Indeed it is found in actual practice that the forms are known by sight as quickly as this simple list of formulæ is learned.

I have chosen and had made some sets of instruments upon this idea, and find from actual use that three angles is quite enough for my personal use. It is necessary only to add a list of spoons, enamel instruments, and a few long blades for reaching into deep cavities, to make the set complete. A list of special forms for special uses, the formulæ for which are constructed upon a similar plan.

It will be seen now, I think, that the infinite variety of widths, lengths and angles of blades without definiteness or restriction of any kind, except the fancy of those ordering instruments, is responsible for the chaotic condition of the forms of cutting instruments. It is my belief that for school work a strict limitation of instru-

ment forms to those that may be accurately designated is desirable.

SELECTION OF SYSTEM OF MEASUREMENT.

If we have decided that a system of formulæ based upon measurements of widths, lengths and angles of blades is desirable, the next point will be to agree upon the particular system of measurement to be adopted.

For the measurement of widths and lengths we have the English inch and the French millimeter. Of these I should choose the French system for two reasons. *First*, from the present indications it seems that it will in time become the only system employed in scientific work. *Second*, the length of the unit seems much more convenient for the work; particularly is this the case if we use the tenth of the millimeter for all measurements of breadths and the millimeter for all measurements of lengths of blades. This seems to be so evident that I have adopted this, pending discussion.

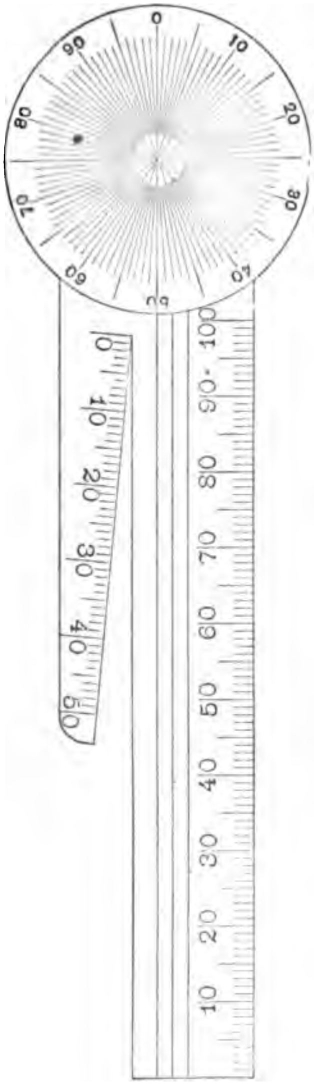
The adoption of a system of graduation of the circle for the measurement of angles is a graver problem. The astronomical circle with its graduation of 360 degrees is far in excess of our needs and becomes cumbersome, because of the minuteness of its sub-divisions. On the other hand, it is the division of the circle most used and best known. The mariner's compass with its division of the circle into 32 points seems insufficient. The division of the circle into 100, the centigrade circle, seems very much better suited to our needs. In this, 25 centigrades is a quarter of a circle, and equal to 90 degrees of the astronomical circle. The quarter circle is about all that we use and the graduations of this are much more quickly caught and appreciated than in the larger number of divisions. I shall use this pending further discussion.

THE GAUGE.

With the view of making the preparation for this work as nearly perfect as possible, I have had a gauge made in steel for instrument measurement. It consists of a circular head graduated in hundredths, and an attached bar ruled in parallel lines for the measurement of angles. The bar is also graduated in millimeters for the measurement of lengths. For the measurement of widths a supplemental bar extends beside the main bar, leaving between the two bars a gradual widening or V-shaped space, which is graduated in tenth-millimeter widths up to fifty-tenths or five millimeters. This is found very convenient for the measurement of widths of blades, the sizes of plugger points, and the diameter of burs.

FORMATION OF FORMULA NAMES.

For the formation of formula names of excavators, three points are considered, viz, the width of the blade, the length of the blade, and the angle of the blade with the shaft. All other points are left to be guided by the rules that have been given in part first. These (width, length and angle of blade) are exactly the points that go to make up the individuality of the several instruments of any order, sub-order, class or sub-class, and will certainly identify each. The particular conformation of the shanks and the handles are left to the individual manufacturer, or, to the taste of the person ordering instruments. Neither is it considered important to this system that the angles be made sharp and definite, or that they be made in the form of moderately short curves. All such points in construction can be left to the taste of the manufacturer. At least the system now proposed does not take them into consideration.



THE MEASUREMENT OF INSTRUMENTS.

In the measurement of instruments for the formation of formula names, first try the width of the blade in the V-shaped slot of the gauge, which will give the width in tenth-millimeters, and set this down as the first figure of the formula. In this the tenth-millimeter is to be used as the unit. Next measure the length of the blade from the center of the angle to the cutting edge in millimeters and set this down as the second figure of the formula. In this the millimeter is used as the unit. Third, find the angle of the blade with the shaft and set that down as the third figure of the formula. In making this last measurement, lay the handle of the instrument

on the main shaft of the gauge, parallel with the parallel lines, and with the point turned toward the small numbers of the circular head. Now move the instrument until the angle of the blade coincides with one of the lines graduating the circle, being careful to keep the handle parallel with the parallel lines.

If we have measured a hatchet and the numbers give—width, 12; length, 5; angle, 6, the formula name will read "Hatchet, 12-5-6." If it be a hoe, the formula will be the same and we call the instrument "Hoe, 12-5-6," the class name always preceding the formula name. This distinguishes both the kind of instrument and the size and angle of the blade of each. In this way we name each instrument of the set, no matter what its class and size, as "Spoon, 20-9-12" or "Spoon, 15-18-12," or "Enamel Hatchet, 15-8-12," or "Enamel Hatchet, 10-6-12," etc.

It is also understood that the edge of cutting instruments shall be at right angles with the length of the blade, unless otherwise specified. When some other angle is desired, it is measured in the large numbers in the last quarter of the graduated circle by moving the instrument without turning it over, and still keeping the handle parallel with the parallel lines of the gauge until the angle of the edge coincides with one of the centigrade lines, and that number is set in brackets following the width number, thus, Gingival Margin Trimmer 20 (95)-9-12 or Gingival Margin Trimmer 20 (80)-9-11.

FORMING INSTRUMENT LIST.

We have now made our rules of nomenclature by which we may accurately designate individual instruments. I will now explain the scheme for grouping instruments in formulæ lists which serve to limit the number of forms and to bring those chosen into intelligible order The appreciation of the value of regular order in the formation of instrument sets has been arrived at rather slowly, and largely from studying the difficulties of students in learning the forms of their instrument points. With the methods that have prevailed few persons learn to think in their instrument forms. They have to search for the proper instrument instead of reading it in the case before them. It is that we may be able to teach pupils to think in their instrument forms that we strive to construct graded sets in formulæ nomenclature; and these should be placed on such lines of gradation, or be so grouped, that the mind easily follows from one to another throughout the set.

It is not difficult to do this with any of the forms of excavators, but some of them are more easily arranged than others. The ordi-

nary hatchets and hoes present the greatest variations of size and angle of blades, but fortunately are the most easily graded into sets. Carpenters' augers are made in gradations of sizes of 1-32d inch, making the most perfect set. Another set is made on gradations of 1-16th inch, this set containing but half the number of the first. Still another set is made on gradations of 1-8th inch, containing but 1-4th the original number. Yet each of these sets is complete upon its individual lines, and each of the smaller sets is contained in the larger.

For the ordinary hatchet and hoe excavators we may readily do a similar thing by first constructing a list of formulæ on regular gradations that will cover the useful sizes and angles of blades, and then cut out all of certain dimensions or angles in the formation of shorter lists. This is not so readily done in spoons, enamel hatchets and some other forms, for the reason that in these we do not require so many instruments of a given class. These also require different formulæ names, for the reason that the blades are of different dimensions from those of the hatchets and hoes. They must therefore be placed in a different formulæ list in which we can group together such instruments as agree in dimensions of blade. If necessary we may make several formulæ lists. At present I will propose three divisions, naming each as follows:

Ordinaries are the common form of hatchets and hoes, many of which are found in every operating case.

Specials are those instruments designed for special acts in excavating, such as spoons; enamel hatchets, chisels, etc.

Side Instruments.—These are selections for some particular purpose, only one or two of which are wanted in the instrument set, and which is not desirable to include in a regular formulæ list.

ORDINARIES.

After a long and careful study of the dimensions, proportions and angles of blades of the hoe and hatchet excavators used by dentists and generally on sale in dental depots, I am of the opinion that nearly or quite every dentist will find in the following formulæ list about everything he will want:

SET OF ORDINARIES, NO. 1.

14–6–6, 12, 18 and 23.
12–5
10–4
8–3
6–2
4–1
forty-eight instruments.

Formula lists for ordinaries will be given in this form. The first figures gives the width of blade; the second the length of blade; the third the angle of the blade with the shaft; and the additional angles used are given in the first line only, divided by commas.

Each of the dimensions of blade is to be made in each of the angles given both in hatchets and hoes. The list is to be read: Hatchet 14–6–6, hatchet 14–6–12, hatchet 14–6–18, hatchet 14–6–23; or hoe 14–6–6, etc., for the first line; and hatchet 12–5–6, hatchet 12–5–12, hatchet 12–5–18, hatchet 12–5–23; or hoe 12–5–6, etc., for the second line. This is continued in the same way for each of the dimensions of blade. ***The formula of each instrument is stamped upon its handle as a convenience to the student in learning his instrument points.***

According to the rules for contra-angling given in Part First, page 10, hatchet and hoe 14–6–12 would be binangle contra angles. Also hatchets and hoes 14–6—18 and 23
12–5
10–4 would be triple angle contra angles.

There are in the set twenty four hatchets and twenty-four hoes, or forty-eight in all, and if generally adopted as the full list of ordinaries would, I think, be found satisfactory.

In making shorter lists I would cut out all of certain dimensions of blade, or of certain angles, preserving the regular order of formulæ names for those retained. As the least desirable I would first remove all of dimensions 14–6 and 4–1, thus:

SET OF ORDINARIES NO. 2.

12–5–6, 12, 18 and 23.
10–4
8–3
6–2
thirty-two instruments.

This set is a most beautiful gradation of the ordinary forms of excavators, and really embraces about all that any dentist would want in his case. But these are properly a greater number than most persons would desire.

For the next set I would remove all of the dimensions 10–4, thus:

SET OF ORDINARIES NO. 3.

12–5–6, 12. 18 and 23.
8–3
6–2
twenty-four instruments.

This is also a very effective instrument set, but if there are still too many I should remove all of the angle 18 centigrades, thus:

SET OF ORDINARIES NO. 4.

12–5–6, 12 and 23.
8–3
6–2
eighteen instruments.

This I regard as an especially desirable list for school work. It is the list I have used most except that I have used the dimensions 5–2 instead of 6–2, but in the future will use the 6–2.

Now, for a still shorter list, and the shortest that I could recommend as reasonably efficient, I would retain but two dimensions:

SET OF ORDINARIES NO. 5.

10–4–6, 12 and 23.
6–2
twelve instruments.

This is a list of six hatchets and six hoes excellently graded to the requirements of the student—indeed I do not know how we could better select this number of instruments.

In the instrument sets given we have five, differing widely in numbers, but in each the formulæ are complete on the lines laid out and every instrument is a good one. The smaller sets are all contained in the largest, and are so arranged as to give manufacturers the least trouble in supplying classes. If manufacturers will make up List No. 1, or even List No. 2, and make these their stock instruments in ordinaries, there are few wants in this line that will not be supplied by them. From them any school that may desire to introduce the formulæ plan of nomenclature in teaching will be able to choose a satisfactory list. Within a few years this may become the plan of the dental profession, and the manufacturers will be relieved from the loads of dead instrument stock they are now compelled to carry. That other instruments in this line will be demanded goes without saying, but they will be fewer in number as discussion of plans and methods under conditions of greater accuracy of understanding proceeds.

SPECIALS.

In the list of specials I will give such only as I have defined in part first. These seem to me from my personal study and use of cutting instruments to be best suited to our present methods of preparing cavities. I will first give what I regard as a complete list,

and afterwards cut it down to smaller numbers, removing such instruments as can be spared with the least detriment to effective school work. It is to be understood that each full instrument set is to contain a list of ordinaries and a list of specials. The list of specials will contain numbers of classes instead of a great variety of sizes and angles of two classes, as is the case with the ordinaries. We do not require many sizes and angles of blade in any one class of specials. After a careful study of them it is found that most of them may be arranged upon practically the same formulæ numbers. There are a few, as the straight chisels and the cleoids, which will not require the full formulæ terms to sufficiently designate them. Three widths of blade seem to me to be the most that will be necessary, and nearly all may be of the angle 12 centigrades, a few only requiring the angle 6 centigrades. The length of blade may be on the same lines in all but the discoids, the length and breadth of which are necessarily the same.

LIST OF SPECIALS NO. 1.

Enamel hatchets	20–9–12 Pr. R. & L. bevels.
Enamel hatchets	15–8–12 Pr. R. & L. bevels.
Enamel hatchets	10–6–12 Pr. R. & L. bevels.
Spoons	20–9–12 Pr. R. & L. curved.
Spoons	15–8–12 Pr. R. & L. curved.
Spoons	10–6–12 Pr. R. & L. curved.
Spoons	20–9–6 Pr. R. & L. curved.
Spoons	15–8–6 Pr. R. & L. curved.
Spoons	10–6–6 Pr. R. & L. curved.
Gingival margin trimmers . .	20 (95)–9–12 Pr. R. & L. curved.
Gingival margin trimmers . .	20 (80)–9–12 Pr. R. & L. curved.
Gingival margin trimmers . .	15 (95)–8–12 Pr. R. & L. curved.
Gingival margin trimmers . .	15 (80)–8–12 Pr. R. & L. curved.
Binangle chisel	20–9–6. One instrument.
Binangel chisel	15–8–6. One instrument.
Binangle chisel	10–6–6. One instrument.
Straight chisel	20. One instrument.
Straight chisel	15. One instrument.
Straight chisel	10. One instrument.
Discoid	20–2–12.
Discoid	15–1½–12.
Discoid	10–1–12.
Cleoid	20.
Cleoid	15.
Cleoid	10—thirty-eight instruments.

This gives a list of thirty-eight special instruments. Several other forms might be added, but to me they seem unnecessary.

They can be added, however, upon the same plan of formulæ used in this list, or if necessary still another formulæ list may be arranged. This list will give rise to more difference of opinion than the list of ordinaries, for the reason that they are designed for special uses in excavating, and persons who excavate cavities differently are likely to want different special forms. Such differences, however, have no reference to the formulæ plan of nomenclature, as other forms can as readily be brought into this system.

In this list of specials each instrument is designed for the performance of a special act in excavating. The enamel hatchets are designed for chipping enamel by hand pressure in opening cavities in the bicuspids and molars. They are beveled rights and lefts and are somewhat distinctive in form and use. When the manner of handling them and their adaptation to place of use has been learned, they are unusually effective instruments. Indeed, besides their use in chipping enamel, they become the principal instruments for cutting out and forming both mesial and distal cavities in the bicuspids and molars, both upper and lower. Their angle of blade and form of edge is such that they naturally cut these cavities into proper form. And when properly supplemented by burs, they are very effective in extending these cavities for the prevention of the recurrence of decay at the gingival margin, or at the bucco-gingival and linguo-gingival angles.

The spoons are for the removal of carious or softened material in any position, but more especially in the large cavities in the bicuspids and molars, also for uncovering exposed pulps the broader blades are invaluable. Of these spoons the pairs in 12 centigrades angle seem to be preferred, though the 6 centigrades angle are the instruments heretofore generally in the market.

The gingival margin trimmers, two pairs of which are of one size, and another two pairs of another size, are for the one purpose of smoothing and beveling the marginal angle of the gingival wall in proximate cavities in the bicuspids and molars. For this purpose they have the cutting edge ground to a definite angle with the shaft. This is made 80 centigrades in the one pair, which fits them for mesial cavities, and 95 centigrades in the other pair, which fits them for distal cavities. The smaller pairs serve this purpose in places too narrow for the entrance of the 20 tenths width of the larger. These are the only instruments in the list that have cutting edges other than at right angles with the length of the blade.

Of chisels I have placed six on the list. Three of them are straight, and the width of blade only is given in the formulæ name,

as chisel 20, or chisel 10. All have cutting edges at right angles with the shaft. Those designated as "binangle chisels" have the full formula name with an angle of 6 centigrades. They are so contra-angled as to bring the working edge in the line of the shaft. The six form a very effective set for chipping enamel in the opening of cavities, and in trimming the walls to form. The angles of the binangle forms adapt them admirably to the trimming of buccal walls in molars and bicuspids in places where a slight angle of blade is necessary to reach the best position for cutting.

The discoides perform much the same office as spoons, and are available in positions of easy access. When direct access can be had, they are to be preferred.

The cleoids are available for almost any purpose demanding a pointed instrument. I use them much in opening pulp-chambers in upper biscupids, and in beveling lingual enamel margins in incisors, also frequently in following out fissures in molars.

In forming sets of these of fewer numbers I would first cut out the list of spoons in six centigrade angle; second, the list of cleoids, and third, the discoids; fourth, the gingival margin trimmers 15(95)–8–12 and 15(80)–8–12, leaving the list stand thus:

SET OF SPECIALS, No. 2.

Enamel hatchets	12–9–12 Pr. R. & L. bevels.
Enamel hatchets	15–8–12 Pr. R. & L. bevels.
Enamel hatchets	10–6–12 Pr. R. & L. bevels.
Spoons	20–9–12 Pr. R. & L. curved.
Spoons	15–8–12 Pr. R. & L. curved.
Spoons	10–6–12 Pr. R. & L. curved.
Gingival margin trimmers .	20 (95)–9–12 Pr. R. & L.
Gingival margin trimmers .	20 (80)–9–12 Pr. R. & L.
Binangle chisel	20–9–6.
Binangle chisel	15–8–6.
Binangle chisel	10–6–6.
Straight chisel	20.
Straight chisel	15.
Straight chisel	10—twenty-two instruments.

For a still shorter list and the shortest list of specials that I could recommend, I would cut out from Set No. 2 all of the dimensions 10–6, thus:

SET OF SPECIALS, No. 3.

Enamel hatchets	20–9–12 Pr. R. & L. bevels.
Enamel hatchets	25–8–12 Pr. R. & L. bevels.
Spoons	20–9–12 Pr. R. & L.
Spoons	15–8–12 Pr. R. & L.

Gingival margin trimmers . . .	20 (95)-9-12 Pr. R. & L.
Gingival margin trimmers . . .	10 (80)-9-12 Pr. R. & L.
Binangle chisel	20-9-6.
Binangle chisel	15-8-6.
Straight chisel	20.
Straight chisel	15—sixteen instruments.

This list is really quite effective, though one who has become accustomed to the smaller sizes will miss them.

Of these lists No. 2 of the specials, combined with No. 4 of the ordinaries, makes an excellent set for school work. It contains thirty-four instruments, every one of which will come into active use in the ordinary infirmary practice.

Also set of specials No. 3 combined with set of ordinaries No. 5 makes a well-chosen short set of twenty-eight instruments that is quite effective for school work, though some very desirable instruments are missing.

These lists are extremely simple in their formula nomenclature and are easily learned by pupils. Of course other combinations of these lists may be made at will. Yet it is important that the direct relation of the formula names be carefully maintained in any lists made up for school use.

SIDE INSTRUMENTS.

Side instruments should be made to definite formulæ, that they may receive definite names. For instance, in breaking up the list of specials for the formation of smaller lists, discoid 20-2-12 may be retained as a side instrument, or one of the cleoids may be retained. I like to have in the instrument list as side instruments hatchets 5-3-28 and 3-2-28 for cutting retention grooves in the incisal angle of incisor cavities. It will be noticed that the formulæ of these latter do not follow the lines of the list given. The number of such instruments added to working sets in schools should be limited to a very few favorite forms for some special use. Any considerable number of them will certainly cause confusion in the minds of students, and interfere with the easy mastery of the list as a whole.

Other formula lists may be added when desired. This year I have used an additional list of long slender blades expressed thus:

Hatchets and hoes—12-8-12 and 23.
8-6.

Of these the blades in 12 centigrades angle are most excellent instruments for deep cavity work, and yet my experience thus far in teaching leads me to the conclusion that the introduction of this

third formulæ list is undesirable. In other words, instruments in the other two lists so nearly take the place of these that it seems undesirable to burden the students with the additional list.

There is really no limit to the number of lists that might be formed by this method, and if I have now made this clear I have finished my task in this direction. But the more important consideration is the limiting of the instrument forms to definite lines easily followed by the student and readily supplied by the manufacturer.

It must be distinctly understood that in ordering instruments by the formulæ plan the class name of each instrument must be given with its formulæ—as Hatchet 12-5-6, or Spoons 20-9-12.

It seems very desirable that some rule be established as to which instrument shall be called the right or the left in the instrument pairs. I will suggest that this be based on convenience of use in the right hand. That blade which, when held as a pen with the point downward, has the convex side of the blade to the right is called the right-hand instrument; and the blade which has the convex side of the blade to the left is the left-hand instrument. In beveled rights and lefts the beveled side corresponds to the convex side of curved blades.

Teaching Instruments and Instrumentation.

When the time came for opening school this year, I felt that I could not begin without putting the plan for formulæ names to trial. The teaching of the mechanical forms, the adaptation of forms to the ends to be accomplished and plans of instrumentation were begun in Northwestern University Dental School this year under extreme disadvantage. It was really impossible that it should be otherwise in the beginning. It has come upon a class of three hundred and five pupils—juniors and seniors—after they have accomplished a part of their course by other methods, and with instruments of different forms. To make matters worse, on account of the slowness of manufacturers, together with the extraordinary demand for the particular instrument set used, only a portion of the pupils could be promptly supplied. This has been a great drawback to effective work. Yet the experience gained thus far has been a most valuable study of the effectiveness of the method and of the plans to be employed in teaching. Most pupils who obtained their instruments in time learned to read their points readily and have made rapid progress in instrumentation.

The proper place to begin this teaching is in the operative technic class; and for this purpose the pupil should be required to ob-

tain his cutting instruments in his freshman year. One of the first and most important steps is to give the pupil a good working knowledge of the value of the millimeter, of tenths of a millimeter, and of centigrade angles. He should attain this in such degree that he will be able to cut bits of paper, or of some soft metal, five, ten or fifteen tenth millimeters wide, or five or ten millimeters long with reasonable accuracy without the use of the gauge; and to form any given angle. In this study he must first work with the gauge or with the printed form. A very excellent instrument for this study is the Boley gauge, an instrument that is specially well adapted to measuring teeth, and many other things in school work and in the dental office. As this is being accomplished the instrument forms are presented one by one, as hatchets, spoons, hoes, etc., and the mechanical features of each, the nomenclature of its different parts, and the relation of the instruments to each other explained. The capabilities of each form will be familiarized by exercise in their use in carving in bone, and forming cavities in teeth. In doing this, correct instrument grasps, and finger and thumb rests, will be taught. The pupil is then prssented with the various sizes of each form and learns to distinguish them and to use their formulæ names.

In this way the pupil becomes fitted to enter the junior year in which this teaching begins to be put into actual practice in the mouth. Now a review of the instrument forms, their nomenclature, and the uses of each, is made in connection with the teaching of the preparation of cavities. In this the lecturer and the demonstrator at the chair become able to direct the student effectively, so that his use of instruments is begun correctly, and comparatively rapid progress made on right lines. This much neglected branch of operative dentistry, instrumentation, can now be taught effectively.

Cavity preparation, in my conception of it, should proceed in a definite order, step by step, which a student should be taught to observe strictly, to carry out with certain instruments, and with fairly definite methods of instrumentation. It is only when he is able to accomplish this work upon a definite system that he should be regarded as able himself to form his lines of procedure in such a manner as will lead him to that high degree of skill in the future which we desire that our pupils should attain.

Discussion of Professor Black's Paper.

Dr. George E. Snow, of Buffalo: The subject has been so well covered that I scarcely see how I can say anything of interest. The system is certainly all that is required for any ordinary set of instruments, and I can scarcely imagine a case where I should wish anything different. There was one point made in the paper to which I wish to take exception, and that is in regard to the formation of the bend of an instrument; that that should be safely left to the desire of the instrument maker as to whether the angles should be sharp or curved. I think it makes a great deal of difference whether an angle is sharp or curved. If the angle of a steel instrument is made sharp, the instrument is not so strong. I will cite as an instance excising forceps which have a hexagonal or octagonal blade. The instrument makers file them to a sharp angle. Now, if these excising forceps are brought to a severe use they will break on that account. If steel is used in the corner they would be much stronger. This is the case with some of the excavators. A sharp angle is not so good. Then the form of cutting edge is a matter which might be considered. If an excavator is used for scraping out a cavity, and it has a square edge as some of these have, it leaves little grooves in the dentine which it will be impossible to fill with gold, so that we may have a leaky filling. The excavator should be more or less rounded; in place of giving it a direct movethe hand should be rolled a little to the edge. You leave a series of grooves, and the gold forced into this cavity should be made tight. If the instrument is made with angles, the size of the cut giving an angle like this (indicating), no one can force gold into the extreme corner of the cavity, consequently there is apt to be a leak. With these exception the paper meets with my views exactly.

Dr. H. A. Smith, Cincinnati: I enjoyed Professor Black's paper very much. I am going to get a copy of it and recommend it to the young gentlemen who may come under my care. It is certainly a step in the right direction. It occurred to me during the reading of the paper that a good part of the time spent in operative dentistry is wasted in hunting around for the right thing. I am going home and dump all my excavators into the river and get a set of these. I have got bushels of them. As old as I am in the practice of dentistry, I am wasting time daily in hunting for for the proper instrument. I keep holding on, hoping there will be devised an instrument that I want. Most of the excavators ought to be in the bottom of the river.

I agree with Dr. Snow with reference to the cutting edge. We have had a great presentation of this subject. The more we study the subject and the longer we live, the more we will thoroughly appreciate it. I take off my hat in defference to Dr. Black, for he has done more for operative chemistry than any man living. (Applause). His text and demonstration in reference to the preparation of cavities are certainly the very best we have ever had, and if we follow his suggestions and methods in this regard and adopt his instruments, we shall do what is right. One of the best operators in the State of Ohio made a remark the other day to the effect, that after all the years of service he had spent in the practice of dentistry and the very best efforts he could put forth in operative work, he said it was a failure. Think of that, young man. Those of us who have operated for years are humiliated by our failures. If we take a fresh start and study the preparation of cavities, as Professor Black has demonstrated to us, we may arrive at a different conclusion as to whether operative dentistry is a failure or not.

Dr. A. W. Harlan, Chicago: The point that Dr. Smith made seems to me to be of very great importance to the dentist. I should say that the system that has been presented by Dr. Black this evening is only an advanced step in the teaching of operative dentistry. Having all instruments in their proper places, has been one of my customs for a long time. It is time-saving. The mixing of different forms of instruments in a loose way in the drawers or the case causes much loss of time, and this system will certainly be of great benefit not only to dental students, but to men who are engaged in the practice of dentistry.

The remarks that Dr. Snow made with reference to the surface left, it seems to me, might be well worth thinking of, and I should say instead of the angles of excavators being triangular or otherwise, that they be more nearly right angle, and unless great care was used in the preparation of the cavity, certainly right angle grooves in a cavity of small dimensions must be very hard to fill with cohesive gold. The question of whether that would be an aid in retention is an important one. I should prefer that the surface be as nearly uniform as possible, or in waves or ripples, as the gentleman said, than there should be so many acute angles. In a paper that I heard read some years ago with reference to the form of cutting instruments, it was stated that the cutting edge should always be as nearly as possible on the line of axis of the shaft, as Dr. Black denominates it. I think that is quite correct, and any one who has studied the forms of instruments must know that those battle-ax

excavators, where the cutting point is so far from the line of axis of the shaft, must be instruments that we can readily dispense with. As a whole, I should think that the system was a very admirable one.

Dr. J. N. Crouse, of Chicago: This work is a little different from mine, and yet I have given as much thought to it from time to time as most dentists. I have made the criticism many times that a young practitioner of dentistry when he starts out, if he has got money enough to pay for instruments, or if he has credit to get them without paying for them, he will get more instruments than he will ever use. It was the case with me. I got a great many instruments that I never used. This is true of excavators and pluggers. If the National School of Dental Technics could bring about reform in another direction, namely, that these instruments should be used more, and the dental engine less, in our dental schools, it would be a good thing. I think the dental engine should be abandoned in a dental school until the last year; first and second year students should not be allowed to use it. Why? Not because they cannot accomplish the work with it, but because they do not do enough hand instrument work. They do not manipulate well. I would also abandon the rubber dam for a while; I would teach them to keep a cavity dry for three-quarters of an hour at a time. Our young men do not know how to do that.

I have been very much interested in Dr. Black's work along this line; I have heard a great deal of talk about it. I have not studied it enough to go into details regarding forms of excavators. Some system should be taught students, so that they shall not go to work and buy a lot of truck which will be of no use to them in practice.

Dr. Black (closing the discussion): I have very little to add. I am perfectly aware of the difficulty of discussing such a subject as this on its first presentation; it requires some study of it to gain that familiarity with it which is necessary for a discussion of its merits. I had intended to ask my pupils who were here to pick out instruments of various shapes, and so forth, to show you how readily it is done, how readily any one in different parts of the house may pick out exactly the instrument I may name; but I found I was taking too much time, and I think you will readily understand how this can be done. My paper was a little too long; I am very much obliged to you for the patience you exhibited in my presentation of it. I only hope you will study the matter carefully with a view to arriving definitely at its contents and of the advantages that may be derived from this system. I do not present it as a final and com

plete system, but something that we can improve upon as the years go by, something that will furnish us with difiniteness in the use of instruments, and when instruments can be discussed by us in a definite way we will soon arrive at definite sets that will stand the test of time in usage.

Dental Anatomy and Operative Technics.

THOMAS E. WEEKS, D. D. S.

This work was presented in the form of a syllabus, with explanatory remarks and illustrated by blanks, charts, models and work, illustrating the course, as performed by students. Mimeograph copies of the syllabus together with a sample syllabus on Dental Anatomy and specimen blanks for measurements and drawings were sent with the following letter, to the teachers of operative technique in every college of the school.

MINNEAPOLIS, MINN , Dec. 1, 1897.

DEAR DOCTOR:—At the coming meeting of the School of Technics I am alloted the morning of Dec. 30th to present the subject of Dental Anatomy and Operative Technics. That all who desire to participate in the discussion may have opportunity for preparation, I enclose a syllabus of the work as I conduct it, which is the basis of what I shall present. In fact what I enclose is the substance of the presentation. Will you not present or have some member of your staff present something upon the subject? It is desirable that all discussions be in manuscript in the form in which you desire them to appear in the published proceedings, and no discussion should occupy more than ten minutes.

As the exhibits have always been an effective feature of the meetings we wish to continue them and make this one even more instructive than any of its predecessors. Will you kindly bring or send to the meeting such an exhibit of Anatomy and Operative Technic work as will show how you do it. If such specimens are arranged in sequence on cards with explanatory text it will be of great assistance to those in charge. Show anything which will be of interest to other teachers.

Trusting that I may have an early and favorable reply, I am

Yours sincerely,

THOS. E. WEEKS,

Dayton Bldg.,

Minneapolis, Minn.

REMARKS MADE BY DR. WEEKS BEFORE PRESENTING THE SYLLABUS.

I will ask your indulgence while I present an outline or syllabus of the course which is practically as I give it in the University

of Minnesota, as it has seemed to me to be the best way to bring the matter before your notice. My experience and association with other teachers has led me to modify the manner of teaching dental anatomy, more particularly than operative technics, and what I have to present as the strongest bearing upon the presentation of the subject of dental anatomy by the laboratory system. Dr. Black's dental anatomy is the basis upon which we pursue our work. The average measurements and charts are made from Dr. Black's measurements, and they are composite models and composite pictures of teeth rather than being individual teeth or reproductions of individual teeth. By a singular coincidence and a happy one, the gentlemen who have assisted me in this work have adopted the scale of fifteen, the same scale which Dr. Black has adopted in his instrument illustrations.

Syllabus on Dental Anatomy Technic.

OUTLINE OF COURSE.

The subject is taught by lectures, illustrated by charts and models made from average measurements of teeth (enlarged 15 times); chalk talks, recitations, and practical exercises. The text-book used, Black's Dental Anatomy, is supplemented by syllabi which direct both the study and practical exercises. Technical terms are explained and defined as they appear in the work. Practical exercises include: (1) *Drawing* of two surfaces of each tooth; (2) *Cutting* longitudinal sections of labial and mesial aspects of incisors, cuspids and bicuspids; and buccal, lingual, mesial, and distal aspects of the molars. (3) *Cutting* transverse sections of the roots of all the teeth, the dissection dividing the root into thirds. (4) Drawing silhouettes of such longitudinal and transverse sections from actual measurements, making pictures of each aspect of three teeth. (5) Modelling in composite clay every tooth of one side; these models are copies of natural teeth enlarged 3 times.

(The author has added the carving of four teeth in ivory or bone—natural size, by measurement).

The features of the work distinctive from those of previous years are: (1) The measuring and recording of measurements of all teeth copied in drawings and models. (2) The substitution of drawings of silhouettes for prints. (3) The reproduction in plaster of the best models of each tooth, to be used in cavity preparation in the Operative Technic work; these models are made by students who show such facility as to be excused from some of the modelling. (4) Preservation, by the teacher, of all perfect sections, so that as cer-

tain teeth become scarce good sections are available for study and for drawing silhouettes.

Drawings of the structure of the several tissues are made in the Histology course which comes in the first year.

The teeth are studied in order beginning with the upper central incisors; all drawing, dissecting, and modelling of each tooth is finished before another is taken up. The work is carried on as follows: 1. Upper central incisors; work as per syllabus No. I. The other teeth are taken up in order and syllabi designed to assist in study and direct the work are furnished each student. Large teaching drawings are made upon enlarged sheets like the blanks which the students use for their drawings. In the lectures special attention is given to the practical bearing of each point upon operative procedure. The deciduous teeth and their relation to the permanent, as well as the arrangement of the teeth in the arch, receive their full share of attention; a sufficient number of dissections and drawings of the deciduous teeth being made to familiarize the student with their pulp chambers and general characteristics.

DENTAL ANATOMY TECHNICS.—SYLLABUS NO. 1.

Study of Terms and Measurements.—1. The tissues comprising the tooth. 2. Crown, root and gingival line, [gin]. 3. The surfaces of the crown. 4. Division into thirds. 5. Angles. 6. Margins. 7. Ridges. 8. Fossae. 9. Grooves. 10 Sulci. 11. Fissures. 12. Developmental lobes and grooves. 13. Interproximate spaces. 14. Formulae of teeth of man. 15. Notation. 16. Measurement—compare Black's average measurements with those of teeth coming under your notice.

Upper Central Incisors, [Notation $\underline{1}$] 1. General form. Each incisor tooth has four surfaces and an incisal or cutting edge. It is divided into a crown and a root, the gingival line making the division. An incisor tooth may be represented by a wedge and a pyramid united at their bases, the wedge standing for the crown and the pyramid for the root [see diagram Form 1.] 2. Labial surface [la.] describe, bound and give markings. 3. Lingual surface [li.] the same. 4. Mesial surface [m] note form and contour. 5. Distal surface [d.] note difference from mesial. 6. Gingival line; note curvature for each surface. 7. Ridges; locate and name those found on each surface.

The Root.—Note carefully the general form and direction of curvature if any; also form, in cross section.

Pulp Chambers.—After making dissection observe carefully the form of pulp chamber, size, form and direction of canals.

Enamel.—Observe relative thickness at various points.

Text: Black's Anatomy, pp. 1–26 and 106–112.

Practical Exercises —1. Make schematic drawing [geometrical figure] on Form 1. of la. li. and in. aspects using average measurements as given by Black for 1, enlarge three times. 2. Make schematic drawing as above, outlining and shading the several surfaces of 1 within the lines of the geometrical figures; the measurements to be of a normal tooth. 3. [a] Select, mount on block and annotate 1. [b] File to expose pulp chamber and canal; finish with fine sand paper. [Every second man cuts a labial aspect, the others cut mesial aspect]. 4. Measure section cut in exercise 3; draw outline, actual size, and record measurements on Form 2. [Each student makes measurements and drawings of each aspect of three teeth]. 5. Select and mount on block 1 having badly decayed crown: with a hack saw separate the crown and root at gingival line; also divide the root into thirds, remount on block with large end up and annotate

1	
5	5. apical third.
4	4. middle third.
3	3. gingival line.

6. Make drawings, actual size by measurement of sections cut in exercise 5, in proper place on Form III. Each student make drawings of sections of three teeth. 7. Make a model of composite clay, enlarged three times, of normal 1 working from measurements, carefully reproducing all surface markings 1.

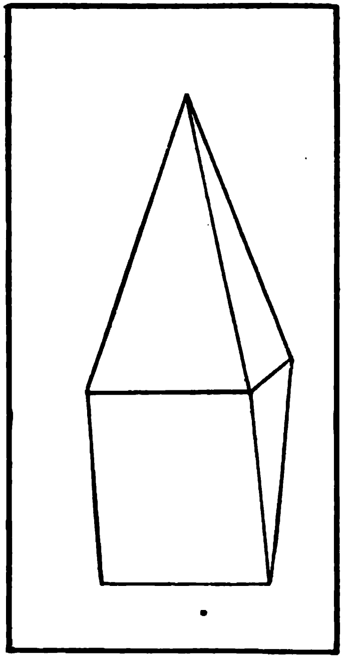
Carve in ivory 1, 4, 6, 6, to size, from Black's average measurements.

Text: Week's Manual of Technics pp. 9 to 14.

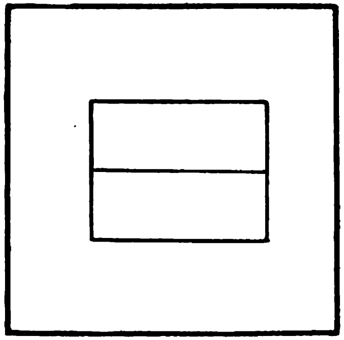
FORM I.

ANNOTATION L'   Mr. Smith.   BENCH NO. B. 16

Labial Aspect.

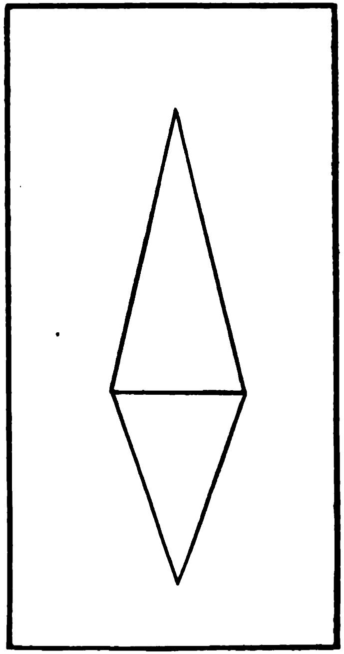


Crown Aspect.



Length over all	22.5
" of crown	10.0
" " root	12.0
Mesio-distal diam. of crown	9.0
" diam. at gingival line	6.3
Labio-lingual diam. of crown	8.0
Curvature of gingival line	3.0

Mesial Aspect.



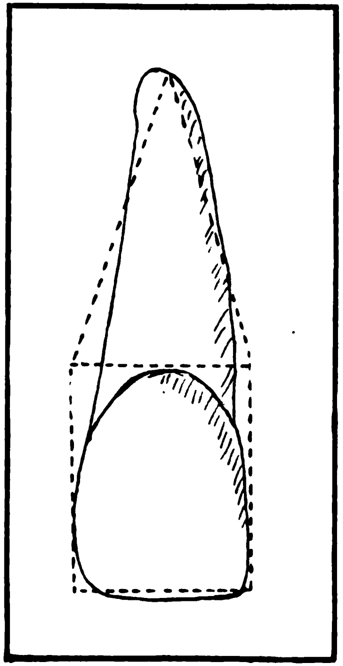
FORM 2.

ANNOTATION L'

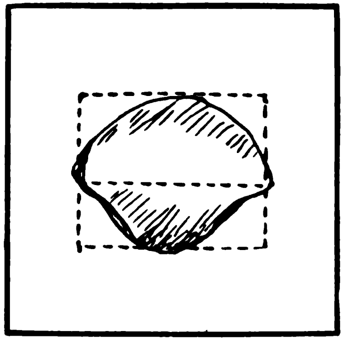
MR. Brown

BENCH NO. H 21

Labial Aspect.

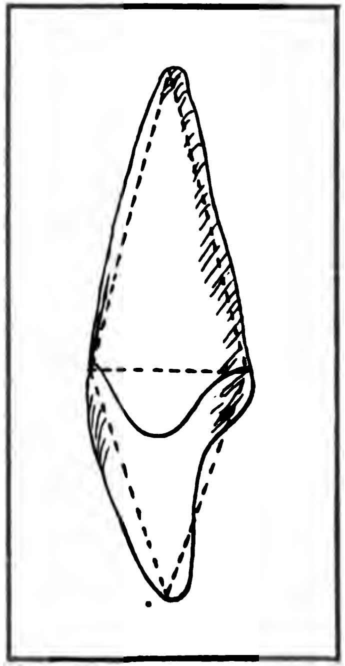


Inc. Aspect.



Length over all	27.8
" of crown	11.6
" " root	16.0
Mesio-distal diam. of crown	9.0
" diam. at gingival line	6.9
Labio-lingual diam. of crown	7.0
Curvature of gingival line	2.9

Mesial Aspect.



Form III.

Bench ....

M........................ ....

Notation........... ...., 189...

5 Apical-third...									
4 Mid-root									
3 Gingival-line..									

3 Gingival-line..									
4 Mid-root.........									
5 Apical-third...									

Remarks: ....

FORM IV.

Aspect.........

Measurements..
- Length over all.............................M. M.
- m-d diameter at contact.............. " "
- " " " gin line.............. " "
- Thickness of enamel on oc surf... " "
- " " " " m " ... " "
- " " " " d " ... " "
- Distance to pulp on oc surf.......... " "
- " " " " m " .... " "
- " " " " d " .... " "

Aspect ....

Measurements..
- Lenth over all.............................M. M.
- La-li diam. of crown........... .... " "
- " " " gin line .... " "
- Thickness of enamel on oc surf... " "
- " " " " la or b " ... " "
- " " " " li— " ... " "
- Distance to pulp on oc surf........... " "
- " " " la or b " .... " "
- " " " " li— " .... " "

NOTE.—This form is here reduced from three each of the above formulæ, making six on each page.—*Editor.*

OPERATIVE TECHNICS.

This course is one of purely operative procedure. Pathology Materia Medica, and Therapeutics are taught by the laboratory method in separate courses. Every operation is thoroughly shown in a demonstration before the class. The course with the exception of cavity preparation in plaster models is given at the beginning of the second year and is divided as follows:

1. *Instruments* { Classification—after Black. Action or use for each form.

Syllabi.—Text as presented by Prof Black. *Practical exercises.* —Making from blanks one excavator or chisel of each of the principal types.

2. Study of the relations of teeth to one another in contact and occlusion, illustrating by models and charts. *Practical exercises.*—Mounting models of natural dentures in Bonwell articulators; cutting off not less than seven teeth so located as to illustrate contact and occlusion, and supplying their places with extracted teeth having cavities in which the pulp is exposed or nearly so.

These teeth must be so placed that when restored by filling, perfect contact, correct interproximate spaces, and good occlusion, or articulation may be secured.

3. *Study of the Rubber Dam* and its application to the several classes of teeth; how to prepare, place, and retain it; the choice of ligatures and clamps; their application; when and how to use them. *Practical exercises* in the several methods of application and retention, using teeth placed in models in lesson 2.

4. *Conservative Pulp Treatment.*—Study should include the treatment, protection and capping of exposed and nearly exposed pulps. *Practical exercises* in applying the vital principles of the best methods, using two of the teeth mounted in Lesson 2.

5. *Canals.* { Gaining Entrance.
Removal of Pulp.
Cleansing and Preparing.
Filling.

Study should cover all the ground; the necessity of the work; the devitalizing of teeth and their subsequent treatment; the cleansing and subsequent treatment of canals containing putrescent pulp. *Practical exercises.* Filling of not less than five canals selected so as to cover the various kinds, those easy and difficult to cleanse and fill. The teeth used are those mounted in Lesson 2.

6. *Cavity Preparation Study* should include (1) classification of cavities based upon causes, location, and form; (2) preparation according to principles governing in each class. This is best accomplished by the use of models and the preparation of cavities in natural teeth in demonstrations by the teacher. *Practical exercises.*—(1) Preparation, by micromillimeter measurement, of not less than six cavities in plaster—reproductions of the models made in Dental Anatomy Technics. (2) Good practice is had in breaking down enamel, opening cavities, establishing cavity boundaries, and removing decay in the preliminary work of lessons 4 and 5. These cavities need not be given typical form but should have *perfect margins.* (3) Some teeth, say two incisors, one biscuspid and two molars should be correctly mounted in a block of plaster or base plate gutta-percha, so as to secure ultimate contour and contact. In these teeth proximate cavities should be prepared for the reception of tin, gold, or amalgam. (4) Six cavities, representing the two sub-divisions of the three classes, may be prepared in the rubber tooth form or in teeth carved from bone or other similar substance, which will be subsequently used for further practice in the use of the metallic filling material.

7. *Matrices.—Study* should cover the reasons for using matrices; the various forms and principles governing them. The dangers attending their use should also be emphasized. *Practical exercises.*—The student should make and apply to the teeth to be filled with amalgam one matrix which occupies but one interdental space and depends upon an adjoining tooth for its retention; and one which occupies two interdental spaces.

8. *Filling Materials.* { Characteristics and composition. Preparation. Introduction into cavities. Finishing fillings.

Study.—Each material should be described, prepared, and used in demonstrations before the class. Physical characteristics should be demonstrated by suitable apparatus to as great an extent as circumstances will permit. Reference text should be restricted to such as deals with general principles rather than with methods of use. *Practical Exercises.*—1. *Gutta Percha* in its several forms. In the applicaion of devitalizing agents and canal dressings in lesson 5, the use of temporary stopping, like Gilbert's, may be taught. In two proximate cavities in adjoining teeth (in models lesson 2) pink base plate may be inserted as would be done for gaining space. Chloropercha and canal points should be prepared by each student. These will be used in lesson 5. *Oxysulphate of zinc* and similar preparations should be used in one of the operations in lesson 4. *Oxychloride of zinc* should be used in one of the canal fillings, lesson 5. *Zinc phosphate and copper phosphate* should be used to fill the remaining cavities and restore the teeth in articulated models to proper form for contour, contact, and occlusion. *Amalgam* should be inserted in the three cavities for which the several forms of matrices have been prepared. *Tin* should be used in the form of foil in cavities of the first class; this will also teach the method of making non-cohesive gold fillings. Tin shaved from an ingot, if used at once, is cohesive and should be inserted in some of the cavities to represent the manner of using cohesive gold. *Gold*—one or two fillings of gold should be made in the technic laboratory to make the student somewhat familiar with its working before going into the Infirmary.

I here present drawings selected from the students of the freshman year, and shows their work, made from sections, cut and mounted upon blocks. This work is familiar to you so I will not dwell upon it.

Right here I will state that each student is required to provide for himself a pair of spring compasses with a sliding screw, I also require the Boley micrometer which Dr. Black called attention to last night. I have adopted the metric system of measurements for the same reason that Dr. Black has adopted it, as it seems to be the system which scientific men have adopted. I stated that Dr. Black's table was taken as a basis. The first figure that the student is required to draw of the labial, mesial and incisal surfaces of the teeth is represented by a geometrical figure made up of two geometrical figures, a wedge and a pyramid, united at their base. The students are instructed that within this figure they may draw the picture of an incisor tooth. See Form I, page 67. We take the incisor teeth and carry them through all practical exercises before they take up the cuspids. The student records Dr. Black's measurements upon the blanks provided, and from these measurements draws figures which include the incisal edge of the incisor tooth. After he has drawn this and submitted it to the teacher he is given an incisor tooth as near typical as can be, and is instructed to measure it with his Boley micrometer and record upon another blank the measurements of this tooth, and from these measurements he draws a second geometrical figure, the first being drawn from Dr. Black's measurements and the second measurement drawn from the measurements of actual teeth. The drawings are enlarged three times. The student is instructed to make his measurements so that he will have a certain number of dots on the paper, and drawing a line from one dot to another will give him a picture of the tooth. See Form II, page 68. For instance, he makes two dots indicating the length over all. He draws a line indicating the curvature of the gingival line, that is, the distance from this dot or line indicates the curvature of the gingival line (illustrating). Here we have the mesio-distal measurement at the contact point. The mesio-distal measurement is shortest at the gingival line. Then by uniting this with a curved line the curvature of the gingival line is shown. Then he is instructed, if it is a central incisor, that the angle must be a sharp one. He simply unites this point and that point (illustrating), making one a little more rounded. There is the crown of the tooth; by uniting that dot and that line, it gives the root of the tooth. The student provides himself with some piano wire of which he makes broaches or explorers before he begins the sections of teeth. He makes fine broaches which will follow the finest canal. He is then taught in the demonstration how the teeth are mounted and annotated on the blocks. He is instructed how to mount the

teeth, to make his observations with the smallest amount of filing, until he is able to penetrate the pulp chamber. The moment the pulp chamber is penetrated he is instructed to insert a canal explorer and file to it. This avoids destroying the canal in the filing.

We have departed somewhat from the old plan of dissection. As you are all aware the idea of a dissection was suggested by Dr. Black, for printing silhouettes. When we used them first they served an admirable purpose. However, from my own experience, students do not get as good an idea of the form of the tooth, the thickness of enamel, the form of the pulp chamber and canals as they should, especially the denser students, and of course it is to them that we must appeal. They did it in many cases perfunctorily and did not get much out of it. At first I simply had them with a pair of compasses make the measurements and lay out a picture of the section, and then by measurements with the compasses draw the thickness of enamel and pulp chambers and the canal, drawing an accurate picture without learning or recording measurements. By doing this I found that they could get more instruction than they could from printing silhouettes. I prepared this blank which I have described, with its measurements, and insisted upon the use of the Boley micrometer, and when they took a measurement with this instrument it was recorded on the blank. I do not ask my students to recite the measurements to me, but I have a check here to know whether they have taken the measurement or not. I do not expect them to remember it so as to recite it, nevertheless it is an important point in the work.

I select a model made in composite clay by a student, which is the best fitted for the preparation of cavities and have it reproduced in plaster by my assistant. A central incisor and upper bicuspid and an upper and lower molar are reproduced in quantities sufficient to supply each man with one. The only thing they do to the models is to finish them up. These are cast in piece moulds. I select two or three students and put them in my laboratory to study teeth and to make these models, and it is a privilege that I find they are willing to strive for, as it gives them much more freedom and they learn more than they otherwise could. I select students who show a special aptitude for the work. Those who show more ambition than others.

I have a system of filing these blocks in boxes. There are eight boxes in a case, and they make a filing case of convenient proportions to place away on shelves or file racks. I have several thousands sections now, and if our teachers would save their sec-

tions it would materially help us. I have found already certain teeth too scarce to supply a class of fifty men, and many of you I have no doubt have classes of double that number, and it is hard for you to get as many sections as you want. Then, too, it gives students an opportunity of seeing a larger variety of teeth and so broadens their vision.

As to describing the tissues, I have a series of charts or schematic drawings which I did not bring with me. They are made up from the best sources of information, including some sections of the teeth drawn under the microscope. The lectures on the tissues of the teeth are macroscopic rather than microscopic, using these charts as a basis.

I have also made some models showing the interproximate spaces, and I begin in my first lecture to the freshmen students to impress upon them the importance of the interproximate space, not only the shape of the teeth as individuals but the shape of the teeth in their relations to other teeth. The two surfaces that receive the most attention are the proximate and the occlusal surfaces, the surfaces of contact, with their fellows in the same half of the arch and the surfaces of contact in antagonism with the other arch.

In plaster models I prepare some cavities and give the students the measurement of them by the Boley micrometer; then I ask them to prepare in the teeth duplicate cavities of the ones I have prepared for them. These are not typical cavities necessarily, but they show the principle that underlies cavity preparation. There are certain principles of cavity preparation which I will not take your time to enter into, that I think should be brought to the notice of every student. After the students have finished their drawings of models and the practical work of dental anatomy, then I give them a talk on cavity preparation and allow them to prepare these cavities in the plaster teeth which are three times the normal size.

You probably have all seen the instruments which Professor Weiss has had the students make so far. Our object is to teach them to repoint instruments if they break them. We teach them the temper of the instruments as well as the form.

In the freshman year the students make models as Dr. Weiss has shown you. One use of these models is for mounting in the Bonwill articulator, supplying eight natural teeth so located as to get contact and occlusion. Upon these teeth are performed the several operations of pulp capping, canal filling, application of rubber dam, and filling with plastics other than amalgam.

I show here models in which cavities were prepared and filled with amalgam. It seems proper at this point, inasmuch as students are going to use amalgam, to teach them the use of the matrix, and its manufacture, so that he may introduce the amalgam fillings into these teeth as they are required to introduce them in the mouth.

The points which I endeavored to bring out are measurements and the use of properly prepared blanks which will make the records of measurements complete. It is proof that they have been made. Second, the presentation of the work as Professor Hoff has outlined to you. First in demonstration, and I want to add my testimony to what he has said about saving the demonstrator's time and accomplishing results by demonstrating systematically. We must have a place where we can get the students together, and where we can have the same materials and instruments they have, and do the things for them, supplemented by syllabi. I have brought along such syllabi as I have already used this winter, and I will crave your indulgence while I read the syllabus pertaining to crown and bridge work.

CROWN AND BRIDGE WORK STUDY, NO. 1.

Crowns depend for their attachment (1) upon a post fitted to and anchored by a cementing substance in an enlarged pulp canal; (2) upon a continuous band which is part of a cap that encircles the root and covers the remaining stump. It is retained by a cementing substance. The stump must have such bulk and form as to insure retention.

The various styles of crowns are represented by the following types:

(a) Porcelain crown with the metal post either baked into the crown or fastened into it with a cementing substance.

(b) Porcelain plate tooth or facing completed by being attached to the post and a plate of metal covering end of root, by solder, which forms the lingual surface.

(c) Porcelain plate tooth or facing as in b, with the addition of a band or collar designed to prevent fracture and decay of root.

(d) A shell of metal encircling root and covering remaining stump. This shell is formed to represent a natural crown.

Text: Am. Text-book of Prost. Dent., pp. 588–589.

CONDITIONS TO BE STUDIED IN THE MAKING AND APPLICATION OF CROWNS.

1. The health of the root and its surrounding tissues. A root to bear a crown must have a healthy pulp; or if devitalized the apical portion of canal must be filled and the pericementum must be healthy.

2. The size, form and position of the root, with their relations to adjoining and antagonizing teeth.

3. Contour and contact with adjoining teeth. The labial or buccal surfaces must be of such form as to preserve the artistic symmetry of the arch. The lingual surfaces must be so formed as to perform perfectly their part in articulation and the lingual surfaces of the incisors and cuspids must not come into undue contact with the antagonizing teeth in any position taken in the act of mastica tion. The proximate surfaces must be formed so as to preserve a correct interproximate space and make firm the contact with adjoining teeth at the proper point.

4. Form of incisal and occlusal surfaces. These surfaces should be formed so as to perform the office of the original tooth and still not come unduly into contact with antagonizing teeth in any position taken in the act of mastication. More crowns fail from improper occlusion than from any other cause.

Text: Am. Text book of Prost. Dent., pp. 589-596.

PREPARATION OF ROOTS.

Study silhouettes of both longitudinal and cross sections to get form of root; also form and thickness of enamel on that portion of tooth between gingival line and free border of gums. For crowns without ferrules, the root should be cut off and ground smoothly to about one millimeter beneath the free border of gum and should follow the curvatures. For crowns with ferrules the enamel should be removed entirely and the ferrule should pass up the root only so far as to insure its edge being perfectly covered by the gums. Where posts are used the enlarged canal should taper gradually toward the apex; it should be oval in section with greatest diameter lab lingually.

Text: Am. Text-book Prost. Dent., pp. 596-603.

Discussion on Dr. Weeks' Paper.

Dr. M. W. Foster, of Baltimore: In connection with the remarks of Professor Weeks I would like to follow him a little with reference to the manner in which we teach tooth forms. Each one of us thinks that the system he uses is the best, otherwise we would change it for something else. I have learned at this meeting a number of things which I am going to suggest when I return home. In teaching tooth form I do not exactly see just where the measurement is required of a tooth. In excavating or preparing a cavity we cannot take a compass or an instrument out of the box to examine the size of the cavity or the distance of a pulp canal from the surface. Our teaching is done entirely by free hand drawing and

not by measurement. During the freshman year the student is obliged to draw from a blackboard, that is, the instructor of this department, who is an artist, makes his drawings upon a board and each student works from that drawing on a tablet of six inches. We have two sections of twelve students each, and we work all of our studies in that way. The student draws a central incisor or a bicuspid on the tablet of paper from the diagram on the blackboard. While the students are working the instructor moves around and watches each student and tears up this slip or corrects that. For instance, in one day the students will use say twelve or twenty slips of paper. If the instructor finds that the drawings are not what they ought to be he tears them up and requests them to do the work again. In this way they take in all forms of teeth.

When it comes to tooth carving, we do this work in soap. Dr. Black, as you know, uses silhouettes, and after reading his work we concluded that we could teach better by having the student see the work, or, in other words, in making a silhouette it requires a few moments for stamping off and many times the student will be thinking of something else; whereas in carving it requires two or three hours, and during this time we think the work is impressed upon the student's mind and he does not forget it. In carving teeth we make *bas-reliefs*, showing just what a silhouette would do. A tooth is cut in two, exposing the pulp chamber and canal. We show the enamel and dentine, and where the enamel is thickest, the cementum and so on. This is colored with water colors, using different colors to designate different things. We do not pretend to give a true tooth as far as measurement goes. We want to impress upon the student the form of the tooth, and not that this tooth is half a millimeter thicker than the other teeth. We do not go into that, but we do try to impress upon their minds the form of a tooth. These are the different forms: This soap I show you is castile soap. I believe some one mentioned that it was rather expensive to carry on this work and I would mention incidentally here that it costs very little. We use pearline soap, and as it is cut up it is given to the janitor to use around the place. We use it in the infirmary for students is washing their hands, so that really we have a big stock of soap on hand and it costs us nothing.

The work I show you now is this year's work of the students, and while it is not as good as some of the recent work it is the best we have at present. The form is not exactly correct, as you can readily see, but these models teach students the forms of teeth. It takes students six or eight hours to carve them, and when a student

spends that much time on anything he thinks he knows a great deal about it. He certainly has had it impressed upon his mind. You will observe three parts of the tooth, the enamel, the dentine and cementum. As to the measurement of teeth, the artist in drawing does not use compasses or measures. If he paints a portrait it is drawn by his eye. He uses free hand methods entirely. He uses a pencil or crayon, taking the object between his eye and the distance of the pencil, and taking a side or lateral view of it. That gives him an idea of what the proportion should be in measurement. So in sculpturing and carving it is the same. The artist does not make any measurements. The artisan who reproduces these from the models measures. He must measure to get the exact reproduction of this artistic piece of work, or modelling, whatever it may be. We take our students in sections of sixteen men around a table so that every man can get within a foot or two of the operation, consequently he can see everything. There is no opportunity for any student to go away as was done in former years, in the clinical department students in the back part of the room would slip out. They would show themselves in order to be marked present and then slip out, giving some one else a chance. I think these things should be taught by demonstrations, and also referred to by the lecturers. Instead of giving it to the whole class, sections of the class should be reduced to as few as possible.

Dr. H. Carlton, of San Francisco, Cal.: As I understand, this gathering resolves itself into a sort of testimony meeting. Each one of us is to tell what he has done or what he expects to do in teaching operative technics. I have made a few notes touching upon this matter so as to get my thoughts in sequence, and I will read them.

Mr. President and fellow-members of the National School of Dental Technics:

The Dental Department of the University of California presents her greetings and extends to you the glad hand of good-fellowship. Upon receipt of your invitation of a few days ago, our faculty, taking immediate action, decided to send a representative to the meeting, and it gives me great pleasure to have the honor to stand here to-day for them, to try and tell, and by our exhibit to show, what our Dental Department does for her students in the line of "Technics."

In 1892 our Dean, Dr. L. L. Dunbar, Professor of Operative Dentistry, mapped out a course in Operative Technics for freshman

students, and put it in my hands for trial and development. The following year I had the good fortune to be present at the meetings of the Columbian Congress, and at its close, the formation of the Association of Teachers of Dental Technics. That this meeting and the papers I heard then read, the discussion that followed, the good advice and assistance I received, did me, and our course unlimited good, goes without saying. I have the satisfaction of knowing from results since then, that we are giving our boys a good course in all the branches of technic work. Still, the best of courses can be improved, and I trust to benefit by the interchange of ideas advanced by older and more experienced teachers, and thereby advance the standard, the prime rule of our college in all departments.

Our course resembles in great part that outlined by Dr. Weeks in the syllabus mailed to us, differing from it only in few details. We do not require the measurements and recording of same, by each student; its direct advantage has not as yet impressed us. Nor the substitution of drawings for prints from tooth sections previously cut. We have, however, in every way encouraged the student to draw from ideal specimens using such as were the more nearly perfect in the class room; the latter plan proving an additional incentive to careful work.

Our understanding of a "Technic" course is one of manual training, not to any great extent didactic, except inasmuch as we follow the adopted text-book of Professor Black, preceding even the text-book work by a study of nomenclature. Then we have aimed to have the manual training course extend beyond the freshman year, and have formed a junior technic course, consisting of a a study of steel, and its qualities, and workings; the making of instruments, and then individual manipulation. A complete outline of the work required of each student. you will find posted with the exhibits. I have been very greatly assisted in the carrying out of the work of both classes by a corps of five (5) assistants, called junior demonstrators, one of whom is with the class all day, and directs them in properly completing the assigned tasks. Frequent conference of the entire corps with our Professor of Operative Dentistry, keeps us all in touch, and the plan has succeeded admirably.

Chalk talks illustrating classes of cavities and formation of same form in important part of the course—preparation of the same before the class on large models, the class doing same later, in bone, submitting their work for inspection to attending assistant demonstrators—and finally handing in the dummy model, (specimens of which you see in the exhibit). Now, as to the exhibit I have

brought with me, permit me to ask you to judge kindly the condition in which some of it has arrived. The unusually long journey and frequent transfer of baggage, the inexperience in properly packing such material, has resulted fatally in a large number of cases. Still there are a few of them left and they show what has been done, and can be done.

The work of the other departments of technics speak for themthemselves—a syllabus of each is attached for your consideration.

We have also a microscopic technic course, and a very satisfactory course it is. Shortness of time prevented my bringing their display. The work comprises a study of the parts and construction of the microscope, details of staining, mounting of sections, etc., etc.

Dr. W. J. Brady, of Western Dental College, Kansas City: I heartily commend Dr. Weeks' paper and thoroughly agree with him excepting with reference to one or two points These I intend to leave out. I thoroughly agree with the spirit of the thing. A knowledge and an appreciation of dental anatomy are the foundation of all operative procedures, not only of one tooth, or two teeth, but of all the teeth, and their relations one with the other, or one tooth with its neighbor on each side, and the opposing tooth on the opposite jaw. A thorough understanding and appreciation of these relations is the beginning of this work. I most heartily endorse the sentiments expressed in the paper of beginning operative procedures with a knowledge of dental anatomy. As I once expressed myself before this Association, the matter of teaching dental anatomy is largely one of form and from time immemorial it has been settled that a knowledge of form was best and easiest taught by modeling or making drawings of the object it is desired to teach, and this is done by using both methods, drawings first. Now, drawings may be objected to by some without thoroughly understanding the subject, saying it takes too long a time. It does not necessarily take a long time if it be conducted properly. The object is not to give a drawing lesson, but to impress by means of drawings, certain facts upon the minds of students, and that is the thing to be kept in mind at all times. Therefore free hand drawings are as a rule not as valuable as those made in another way. The object of a drawing is to make it a certain size, because teeth are of a certain size. If we have only one tooth to deal with we might make it with a free hand drawing; we might make it without any reference to size, but as we compare one tooth with another we want enlargement or diminution as the case may be, as we see fit.

to make it. Why, then, not follow definite drawings. The artist can set his model before a class and say, copy that, or copy this. Copy nature or the composite of the natural teeth as we have it in the specimens given here made from the composites of many teeth. This scheme of making teeth to scale is to be commended. The central incisor is to be determined by certain dimensions of certain parts; a lateral incisor follows it next and is compared with the central. Students want to know which is the larger, the lower central or lateral. The drawings help to impress that upon the student's mind. It serves the purpose of helping him to remember.

The table of measurements given in Black's Anatomy is concise, and plain enough to be easily followed by any teacher. It is standard and always will be until our teaching changes. Therefore, why not adopt it at once as a basis. I have a suggestion to offer, and that is with reference to making these drawings of larger size. I aim to have my students make drawings three times the natural size. When we make moulded teeth models we use plaster instead of modeling clay. When we come to the modeling part of our work in teaching, I have a scale that is larger, six times the usual size and then we have the measurements impressed upon the student's mind, so that when he sees a tooth in the mouth, or deals with it in any way, he can immediately judge whether it is of average, or less, or greater size than the average. I believe this to be valuable. I most thoroughly agree with the spirit of measurements, and I think the time will come when we will measure a great many more things about the teeth than we have been doing.

Dr. G. V. I. Brown, of Duluth, Minn.: The essential idea before us for discussion, and one Dr. Weeks desires especially to emphasize, is the use of compass and micrometer, doing everything by exact measurement, as well as the idea given by Dr. Foster that the artistic should be developed, and that we should depend upon the eye of the student for his drawings. As I understand the matter, the essential idea in this work, and the consideration of its future development, is with reference to methods of operating as well as to eliminate personal equation, and the only way to do that is to have some exact measure which all will go by In dealing with a large class of students you will find men in the class who have had artistic training, who have learned drawing, who have talent in that direction, and what would be a simple matter for these men would be difficult for others who have less education in that particular line, and the probability is without measurements a large proportion of the class will never get a fixed idea in their minds as to what an

exact tooth should be. If you require all students to go by measurements, certainly it will not cripple the man who has natural ability. He will, perhaps, more quickly get a perfect idea in his mind than the man who has not a good eye. Other students in the class will have some independent method by which they can in every instance reproduce a perfect tooth so long as they have a compass and micrometer with them. I think this idea ought to be elaborated in the discussion along that line, whether we are going to develop artists or exactness among students, which will enable them to do their word accurately.

In regard to what we are doing in the Milwaukee school, I need not take up much of your time in speaking of it. In these branches we try to follow Drs. Weeks and Cattell as closely as we can, the essential point of this teaching seems to be the kindergarten idea, and it behooves us at this time to remember that teachers of kindergarten methods are beginning to consider thoughtfully whether after all the kindergarten idea is a failure or not in general teaching. The practical application of the kindergarten idea in many instances has become a failure, for the reason that in seeing but little mechanical work and learning the technic which they do they have forgotten the main idea, mainly, to develop the working together of the eye, hand and mind. Students have made mere machines of themselves. Unless we can so apply what we do it will not raise the standard in the minds of the students, and we will simply make mere machines of them, and when they come to work on patients they are going to be a long way from the operators they would have been if they never had any such training. It should not be applied as a criticism upon the method of teaching, but it is only the manner of applying that method. I am not in a position to criticise because I have been a teacher myself so short a time. I am speaking of the idea that my friend, Dr. Weeks, is carrying out. He has found that the student's time was being wasted, he becoming a mere machine. He has changed from silhouettes because he finds that students do not learn as much from them as they ought to. He has changed them for drawings. In order to make a drawing accurate it should be done according to measurement.

I have here a few drawings from my own school; and there are others on the table, which show at least that we have aroused the interest of the students. You will find some of them elaborately shaded. All the shading and elaboration from the teeth into the full upper jaw is done outside and is entirely optional with the stu-

dent. I think you will agree with me that in this work the student's interest has been aroused.

Dr. J. D. Patterson, of Kansas City, Mo.: I have been much interested in Dr. Weeks' paper, and I heartily agree with nearly all that he said. There is one point that I desire to speak of, and it is with reference to the advisability of teaching students instrument-making. I can probably make as good an instrument as any of you, and perhaps a great deal better, because I spent a great many months at this work, being advised to do so by some friends of mine about twenty-eight or twenty-nine years ago. It has been advised by some speakers, and by Dr. Weeks too, that it is too much time thrown away, and that students should be put to do other work. The time I spent in making instruments and in perfecting my ability to make, shape and temper instruments was considerable. The knowledge and skill and experience necessary to make an instrument that is at all valuable are great, and I have long since questioned the good that I derived from being able to make my own instruments. I do not believe there is anything in it except the manipulative dexterity which I have obtained from it. The artist does not make his brushes: he does not grind his paints. Why should he? Why should we make our instruments? A man said the other day that we were getting out raw material with freshmen students; that we spent one month cutting screws, making caps and nuts, etc. We are not making instrument makers but dentists. I do not think it is advisable to teach students instrument making in the manner in which it has been recommended. I do not make my own instruments. The finest instruments I have ever made do not compare with the instrument that a manufacturer will give me. They will give me an instrument which is better tempered and more perfect than I could make. Why not devote time to doing something which is of more practical value in prosthetic work. We want to make students conservators of human teeth, to be able to supply teeth when the originals are lost. I think I am right in this matter because I have given it considerable attention. I never think of making an instrument now. I cannot see how instrument making is so valuable when there are so many other things more valuable to teach students. In the three years we have to teach him the principles of prosthetic and operative dentistry, the principles of pathology and of surgery, and we find that the time is so crowded that it is difficult to teach these branches in the allotted time. I do not see what use it is. I fail to see what use it was to me. I do not make instruments now as I used to do, but leave this

work to those who can do it better, who have spent a life time at it and who have learned how to do it.

Dr. W. E. Harper, of Chicago: I am very glad to hear Dr. Patterson make some remark on instrument making, and I might as well start on that. I have a few criticisms to make. In formulating a course of operative technics, I look upon it as essential as it enables students to acquire the manipulative skill necessary for performing successfully the operations upon the teeth. Why should we make our own instruments when we can buy them for a mere song? We cannot buy skill and manipulative ability. These are acquired by long experience. Dental instruments can be produced by means of special tools for a mere song. For instance, twenty cents buys any excavator on Dr. Black's list. Can any of you afford to make it for twenty cents? You can no more than buy the material for that price. While you can buy good instruments, you cannot buy skill nor manipulative ability. This comes from cultivation and a technic course in instrument manufacture will serve excellently for this training.

For a course in technique I am inclined to object to the time spent on drawings. I have gone through that mill myself and have fairly schooled myself in drafting. I can do it quickly, and I know what the average student can do in that direction, and the time it takes to do it well. Before I had the models made which I exhibit to you it was necessary to resort to all kinds of schemes to get results in the study of dental anatomy. I found considerable difficulty. With these models I have no need of drawings. I can accomplish results of a practical quiz, or in the actual demonstration of the preparation of forms of teeth or in carvings. The carvings submitted to you as coming from our school were made without any measurements whatever. I mean without any instruments for measurements. They were made from their conception of form by the eye, and I would be most happy to submit the work of eighty per cent. of the students as to their proper proportion, and I do not think you can find work that is made with calipers more uniform in proportion than the carvings I submit to you from eighty per cent. of the class. Those carvings are made after average sized teeth, so that appreciation of the form is learned, in that the dimensions are exactly the same as the tooth the student works from. The ordinary tool maker works to the sixteenth part of an inch. He has no such appreciation of measurements as the bridge maker is called upon to apply, and the bridge maker has no appreciation of the measurements the tool maker works to. Why not

work on forms exactly the size of the average teeth. It is easier to appreciate the outline of surface in a large model than it is when you get something the size of a tooth. The student does not work on teeth thirty times as large, but he works on average teeth. No musician will give a child a small sized violin to teach the technique of what he is to play on subsequently; he will give him what he is to use all his life. The technique he will acquire on a large violin would be useless for a small violin, and vice versa. Drawings, measurements and proportions are brought out practically as in carvings. I would like to illustrate what I mean in this regard by referring to these models. (Here Dr. Harper spoke at some length, using various models for purposes of demonstration).

Demonstrations by these models in teaching are a success. I shall be most happy to demonstrate further to any one of the members the value of these models. They are so large as to be seen by every member of the class. I should be glad also to have members of the class quizzed on dental anatomy, as given in Black's Anatomy, as a test of whether they have become in that short time familiar with the subject, and their knowledge can only be tested in some such way by a quiz. The pupils have made no drawings. I have accomplished better results with models than could be possibly obtained in any other way. In teaching dental anatomy by the use of models we do not require a student to stretch his imagination a particle. If you are describing the labial surface you have a model that can be seen from the remotest part of the room. If you tell the student it is convex, the model will show that it has four margins—incisal, gingival, labial and distal. That it has four angles—mesio-incisal, disto-incisal, disto-gingival and mesio-gingival. Now, the student has located not only in words but the parts I am talking about. This is not so difficult, although it is difficult enough. But wait until we come to the bicuspids and molars. I have asked a student to describe the occlusal surface of a bicuspid and molar and he has done his work to perfection. I could not improve upon it myself, nor could Black's Anatomy. I take a student, as I do in the quiz, draw a model of what I am talking about, and ask him to locate the occlusal surface of a molar and to name the four developmental grooves, which he does. If I ask him to locate the distal groove on the occlusal surface, the probabilities are that he will locate the buccal or mesial; he will locate any other than the distal surface. I ask him to describe, for instance, the central fossa. He answers the question. He tells me just what Black's Anatomy does. He tells me what constitutes the central fossa. If I ask him to

locate it on the model the chances are he cannot do it until it has been emphasized a number of times by failure. I ask him to locate the central fossa and he points to a certain part. I then ask the class, is that correct? In that way I elicit the attention of the èntire class. I am not quizzing an individual. Every student is waiting for an opportunity to pull that man down, to catch him in a mistake, and all the members of the class concentrate their attention on the point he is talking about. If he picks it out correctly, there will be a unanimous cry on part of the class, but if he is in error we may hear some negatives. When the question has been answered correctly, I tell the student to point out to the class where the mistake was in the first place. By doing this I find that students do not make a mistake the second time, for the reason they do not like to be shown up or to display their ignorance before the class. As I have previously remarked, a student is not called upon to stretch his imagination a particle in demonstrations by these models. It is by constant repetition that we instruct students in this work. I go over a model today, and quiz students tomorrow.

Another difficulty we have had to contend with in our school has been with regard to nomenclature. We have adopted a system of nomenclature which is followed out in every department and by every teacher, so that if I use a certain term it has only one meaning, and this nomenclature is taught in operative technics. The first thing we consider is nomenclature. In nomenclature we have a mixing of line angles with point angles, of mixing angles of surfaces of teeth with angles of teeth. For instance, the buccal surface will have a mesio-occlusal angle, a disto-occlusal, mesio-gingival, and disto-gingival. Now, then the occlusal surface has a mesio-buccal, disto-buccal, disto-lingual, and a mesio-lingual, Now we have here a point angle (illustrating) which I emphasize. I do not want them to memorize; I want them to understand the system of naming that angle. It would be impossible for students to memorize these angles without becoming confused when called upon to use them; but they understand the system by which these angles are named. The student is called upon to remember the names of the surfaces. We have the occlusal, buccal, mesial, distal and lingual. We have a point angle that is formed, a mesio-bucco-occlusal point angle—a name given to the mesial, buccal and occlusal surfaces which enter into its formation. We have here (indicating) a mesio-buccal angle; it is named mesio-buccal because the mesial surface unites with the buccal surface, so that if I called upon a student to name an angle here he does not have to remember the name; all he has got to dis-

tinguish is the points of the surface, the distal and lingual, the disto-lingual line angle and so on. Now, in drawing you cannot illustrate this subject so that students can master it within a reasonable length of time; they simply fail.

Again, when we come to consider the nomenclature of cavities the rule is the same. We name the walls, grooves. and angles in cavities, also the walls which enter into the formation of them, also the angles or the points of angles. I do not spend much time in cavity nomenclature. We have a lingual wall because it produces a lingual surface; we have a buccal wall because it produces a buccal surface; we have a gingival wall because it produces a gingival. We have a line angle which would be a bucco-gingival line angle. We have another line angle here, which is a axio-buccal; we have another line angle which would be an axio-gingival; we have a point angle in which three walls of the cavity enter into its formation We have an axial, gingival and buccal, consequently a bucco-axio-gingival angle only means one thing. So a student cannot get mixed up. He does not have to remember these names; he simply learns the rules of names. To repeat: he is seeing what I am talking about; he is not stretching his imagination a bit. In these models we can form any kind of cavity we wish to adopt. We can use these models for nomenclature study of dental anatomy and in cavity preparation. There is hardly a teacher in the institution but what has use for these models every day. With them you will soon dispense with drawings.

In describing the surfaces of teeth on these models, as I describe a tooth each student has in his hand a bicuspid or molar, as the case may be, and as I go over the occlusal surface he is locating it on the tooth in his hand. If he cannot locate it, he looks over the model, and I ask him to locate it again, so that he may locate it definitely on the natural tooth.

Some one raised the point, Is not operative dentistry a failure? Some operative procedures fail, because we have too long neglected the mechanical laws which govern cavity preparation; we have too long failed to appreciate Dr. Black's teaching regarding extension for prevention. This is carried out in our institution with precision —extension for prevention, and cavities are formed on mechanical lines and rules. The models are absolutely indispensable in this work. In the carving of teeth we have to consider the form, and in the accomplishment of this work the student sees nothing but the chisels and excavators he is called upon to use in cavity preparation. He learns by experience that he cannot successfully carve teeth un-

less his instrument is as sharp as a razor. He tries to work with a dull tool for a week or two, but very soon gives it up. He comes to me and says, "I have been trying to carve teeth with this instrument, and I find I cannot do it." I pick up his chisel, and find that I can run it over my hand and it will not do any damage. This emphasizes the necessity of having sharp chisels with which to do carving. The student is taught how to do it by individual instruction, and he soon learns, after he has carved one or two teeth, that there is an easy way to do it, and that is by keeping his instruments sharp. In doing this work, not only does he appreciate the form, but he is only permitted to hold and use the tooth as he will use it in the mouth. Carving has for its object appreciation of form. I can teach a student cavity preparation, as far as cutting goes, in two weeks. I do not believe in plaster models for cavity preparation. I consider the use and management of the instrument as being of more importance than the form of the cavity. If a student can use an instrument, or has an appreciation of what curved lines mean; if he has acquired manipulative skill in the use of the instrument, and the teacher in operative dentistry can talk so that the student can understand him and follow his directions, then teaching of cavity preparation comes easy and results are definite. He mostly cuts cavities in bone of the form that he is called upon to cut in the teeth. I prefer to have students work upon a substance similar to that which they are called upon to work on in the mouth. Again, I prefer to have them cut a cavity practically the size of that which he is called upon to cut in the mouth. In this way he is better able to appreciate small measurements when called upon to put them into use in the mouth.

We have a system of measurements, but it is not adopted by the profession. It will be a great many years before it is, and it is questionable whether it will ever be adopted. There is one way to do it, and that is to cultivate the eye. The Chinaman uses no rule. If it is necessary to cut a cavity six feet long he will cut it six feet, and not six feet and one-sixteenth. You can teach students appreciation of form of measurements if you have proper facilities and use objective teaching.

I know of nothing more that I can say of interest at this time, except in a general way to thank Dr. Weeks for his paper. I think the way to test the merits of these different methods of teaching is not to show the work of an individual student or three students; it is for the technic teachers of this Association to go to other institutions and see what course is being pursued and what the work of the class

is, and not the individual. If the quality of the work of say eighty per cent. of the class is excellent, then we can approve the system of teaching. On the other hand, if you have only half a dozen good students at work, there is something wrong with the method of teaching, or there is something in the course that ought not to be. I would judge from the general average, and not on the individual result. It is the general results that will count.

Dr. Otto Arnold, of Columbus, Ohio: I have listened to Dr. Weeks' paper with a great deal of interest and desire to express my gratitude for the profitable instruction I have received from the various presentations of this subject. Furthermore, I am heartily in accord with the outlines as presented by Dr. Weeks. I also wish to heartily endorse the comments of Dr. Patterson in reference to making steel instruments. I will not say anything more about that, except to compare the making of instruments by us with the surgeons' tools by the surgeon. In a large sense, the surgeon is more of a technical man than is the dentist, and yet he is not expected to make the instruments with which he works. In this connection I will refer to a matter that has long been before the dental profession, namely, the relation between dentistry and surgery. If the dental student spends so much time in the workshop, in blacksmithing so to speak, or work of that description, the distance of uniting the two professions will still be a little greater. This is merely an illustration.

I would like to supplement in a word or two what has been said by Dr. Weeks relative to his outline for operative technics. Another important feature would be histological specimens of teeth, teaching the student the histological form of a tooth will give him a great deal of valuable information in his operative work in after years as to the selection and method of adaptation of root fillings.

Dr. A. F. Webster, of Toronto: I would like to say a word or two about methods of teaching. I do not know whether every teacher is always able to make the class interested in the work he has to do or not. I like what Dr. Harper has said about methods of teaching. Teachers have different methods of presenting subjects to students. There are a few points to be considered besides those mentioned in the paper, and one is regarding the measurement of cavities. I have followed out the plan of making prints, as was first done. Then, from this print, I require the student to turn the paper over and do the opposite side, reproducing the print he has already made without looking at anything, and find out what he has got. After he has done that for each tooth, then we have on

the third day a quiz or recitation. We ask a student to go to the board and make what he thinks is the shape of a certain tooth, and let that be produced. By following this plan students become interested in their work.

As for arranging teeth and occluding contact points with the interproximate space, we have usually plaster casts made in the prosthetic technic department. When I am talking about the occlusion of teeth with each other a plaster cast is produced and the students see how the teeth occlude. Also, you can tell much about the contact points with the interproximate space.

A word or two with reference to rubber dams. Something was said yesterday regarding the inhumanity of asking students to submit to having plaster impressions made of their mouths. We have each student put the rubber dam on his partner. The same is done with clamps in the mouth; consequently a student knows what it is like when a ligature is put around it. A student will soon learn where the dangerous points are, and when he goes into the infirmary he knows how to do that work, and knows whether he is hurting a patient or not.

I wish to say something with reference to syllabi in our work. I think the plain outline by Dr. Weeks is a very good one. I have used it for the reason that we are too poor to have a syllabus printed. We write our syllabi on the blackboard, and let each student copy them. It may take ten or fifteen minutes for them to do this. When you talk about the work put on the board, you can do so with the understanding that the student will refer to his notes and see the outlines of all that has been said upon the subject.

Dr. D. M. Cattell, of Chicago: A few years ago I thought I was the chief mogul in this work, but I find that I am not in it. I used to go for Weeks a good deal with regard to methods of teaching dental anatomy. But to-day he has stretched away beyond me; he is far ahead of the rest of you in teaching dental anatomy as a whole, and there is no question about it either in your minds or mine. One man teaches one part of the subject, spends more time on it, and does his work more thoroughly than another. As a whole, I know that Dr. Weeks' classes show up better than any others, because he has gone over more ground, and I have seen the work of nearly all students that are working very hard.

With regard to instrument making, I agree with Dr. Patterson. We can purchase them for almost a song. When we can buy them so reasonably we do not have to make them. But that is not the idea. We can get somebody to draw for us; we can get artists who

will make better drawings than we can, but that is not the point. In making instruments we are training the hand. We are doing practical work in that direction. Following out the paper of last night, we are getting the students acquainted with instruments. Why do you carve? Dr. Harper has told us the reason why he had his students carve; to make them familiar with teeth. Why do you make instruments? To make students become familiar with them. A student must be acquainted with every curve and angle of his instrument, and in drawing the same way. How many of you, if called upon to draw the cavity in the surface of a tooth which you wish to represent, can do it, so that the rest of us would know what it meant unless it were labeled? Drawing is a very useful thing in connection with dentistry. By taking up drawing a student is studying something which will enable him to present the subject to you intelligently when he is talking to you. The essayist is right in line. The points brought out by him are good ones.

Dr. G. V. Black, of Chicago: I have listened to this discussion with a great deal of interest, and while doing so my thought has run back over this work and its development. There has been continuous progress. Few of you know how difficult it was to get work of this kind started, to get it upon its feet. Perhaps Dr. Cattell knows this better than most of you. It was necessary in the beginning to adopt very simple means. I worked for a number of years before I could get a dissection made and a silhouette printed. There are perhaps one or two of you here who will remember the silhouettes I had made three or four years before any of this work was done in a dental school. Now, we seem to have run away in a large degree from the silhouette prints. We are doing something that teachers generally think better than printing silhouettes. They believe it is more instructive. They are passing on to the drawings, then to carving, and of this and that, seeking that which will instruct to better advantage. This kind of progress, I take it, will continue. The interest in the work will shove it forward and is shoving it forward. The object in having a silhouette is the development of the mind and of finger skill. One teacher may do best in developing the mind by one course, another teacher by another course, and a third by a third course, each having the same object in view, the training of the mind and of the fingers. Even instrument making has its value in the training of the mind and the fingers. Instrument making in steel has a special value, for it is steel with which we work in the preparation of cavities, in the filling of teeth we work

with steel, and until pupils learn to know something of steel and of its qualities they are continually ruining their instruments or trying to use instruments unfit for use. I think a great deal of my own training in the working of steel, and my experience has been somewhat different from that which has been so strongly expressed this morning. The instruments I make are good instruments. There is something in success along this line, in directing one's mind to an appreciation of that which will do a student good. One of the abominations among dental students, and one that makes me feel nervous and fidgety, is ruining instruments by drawing the temper and by various other means until they gradually acquire a knowledge of the physical qualities of steel. The qualities of steel need to be taught to them. That is simply a practical point. It is not so much a point in the development of the mental capacity of the student, or in the development of manipulative ability, but it is a serious practical point, needing culture in all our school work.

Now, this matter of technics is progressing very satisfactorily; it is producing excellent results, and as we progress in it, as we develop our methods, render them more perfect, the culture that we get out of it will be better. One of the most instructive things that I have noticed at this meeting is this: I have seen it frequently. One of the gentlemen was showing the carvings he obtained last year and comparing them with the carvings obtained this year, and with some wonderment that the carvings of this year were better than those obtained last year. Now, why did those boys do better this year than those boys of last year? Perhaps they were not different in quality. I think this, that the outcome of it is that the teacher last year presented the subject of carving with hesitation and doubt in his mind, while this year he presented it with all confidence; hence the difference in the carvings made by the pupils. The attitude of the teacher before his class is all important. Our teachers are improving, as well as our pupils under them, and as they improve the pupils will make greater progress in all of these branches. It is not so much difference as to what particular method is employed, but it makes a great difference how that method is presented to the class.

Dr. Weeks (closing the discussion): I think my object in presenting this work has been fully accomplished. The discussion has been a good one and confined to the points. There were two or three things said by Dr. Black and Dr. Cattell which I had in mind to say. As operators we have different methods; no two men accomplish the same results by the same method, and it is just as

impossible to expect this body of teachers to teach by some particular method as it is to expect all operators to arrive at their results by the same methods. The results may be the same, and it is these that we are after, although we may differ in minor details. I presented my course because it represents my thought, and it was my contribution to this meeting. As Dr. Cattell has stated, I am trying to arrive at results, and if I find with increased experience that the method which I have been using and talking about today is faulty, I will discard it and look for another which will better meet the requirements in accomplishing the desired results. I disagee with some of the gentlemen, and would call attention to one point in answer to Dr. Harper and others. I took the liberty of going to Dr. Harper's exhibit and surreptitiously borrowing one of his blocks. I would like to ask Dr. Harper if he ever saw a student take a tooth, place it on the block and get his measurement. Dr. Harper is teaching almost exactly as I am, and we arrive at practically the same results, although we may go about it by a little different route. But the student does not establish the gingival line on the block with his eye. The student does not do that. When Dr. Harper's back is turned, he measures where the gingival line goes.

With reference to what has been said concerning illustrations, it may be true that the teacher of the violin does not instruct a young pupil to play on the hardest fiddle first; neither will the teacher of the violin attempt to teach his pupil to play a sonata first. In teaching it is our aim to lead the student up by degrees, taking advantage of the peculiarities and the characteristics of boys and their interest in the work and lead them up by the easiest stages to the point that we wish them to achieve.

I will not answer in detail any of the points that I jotted down while the discussion was going on because most of them are well taken. Our disagreements in discussing subjects arise from looking at things from a different standpoint. We are differently circumstanced in different localities, and we are obliged to modify and work to suit those conditions.

I cannot tell you gentlemen how pleased I am with this meeting, because this school originated with a few who took it up somewhat with fear and trembling, and to see thirty men outside of the city of Chicago come here for the express purpose of comparing methods of teaching, it makes me feel good; it makes me feel as if our efforts are not in vain, and I thank you all for the interest you have taken in the subject.

Symposium on General Teaching Methods, Especially those not already Considered.

BY DR. S. H. GUILFORD, OF PHILADELPHIA.

Mr. President and Gentlemen: In corresponding with the officers of this Association certain suggestions presented themselves to one or two members, and I agreed to carry out the idea that was suggested, and it was based upon this, that we started as a Technic Association, devoting our energies and time to that work, and the work that has been done so far has been purely technical in all its bearings. But we are also interested in another kind of work, more strictly, perhaps, pedagogic in character. We have expected to gain a good deal of information from meetings with the National Association of Dental Faculties, but in this particular we have been disappointed. The National Association of Dental Faculties has been so occupied with routine work, which seemed to be necessary of its kind, that it has not had time to take up anything like educational matters. Every year I have gone to their meetings expecting to hear the views of other persons in regard to methods of teaching, and to gain some information, but I have been disappointed. I want to know how men in different schools teach their subjects, and what means they have of determining whether a student understands the subject, and whether the teacher is actually making himself understood or comprehended. The National Association of Dental Faculties has not done that, and it seems to me that the time has come for something of that kind to be done. If the National Association of Dental Faculties has not time for it, it occurred to some of us that this would be the place for that kind of work, for the reason that those who are here are professors; they are all teachers engaged in exactly the same kind of work. Under these circumstances it has seemed wise that some one should make a beginning in this direction, and I agreed to come before you upon this occasion to tell you in a very plain way some of the methods I adopt in teaching and in finding out whether a student understands his subject or not.

I have often wondered when lecturing whether I was making myself thoroughly understood, and I questioned students in a private way when they came to see me, to find out whether they understood what I have talked about. I question them in regard to another thing. I question them in regard to the incidental matters. For instance, I ask them what they think of the drawings I have in illus-

trating my subject; what they think of the models, and what they think of this or that, and frequently I get some valuable suggestions; it is a good plan to question students. One thing more that is important: I ask them whether they can hear me in all parts of the room, and whether I speak distinctly or not. This is a matter that is very often overlooked. How many lecturers in colleges do we find who ennunciate their words distinctly? They may not have powerful voices, but they probably have voices that can be understood if they use them correctly. The other day I read in one of the newspapers (I have forgotten where) a little article on that subject. It impressed me very forcibly. It was stated in this article that a great many public speakers, not, of course, those who have had considerable experience, do not make themselves understood with their voices. They do not handle the voice correctly. This is a matter we all want to consider. When I began to teach I felt that there were two things necessary. First of all, I knew I should have to speak loud enough to be heard in all parts of the room; and in the second place, I felt I would have to try to speak distinctly enough, so that students could understand me. I have labored with those two objects in view, incidentally with other matters for twenty years. These, then, are points that teachers in our colleges should consider.

But what I want to dwell upon particularly is the matter of finding out from students whether they catch exactly my idea, or not. Very frequently students do not understand what you are trying to teach them, and I find no better way of trying to make them understand than by quizzing them, not a quiz in the regular way, but a quiz of my own, to ascertain what they know. I take students at the end of the Freshman year, Juniors at the end of the Junior year, for an examination as to their progress, and question them closely to find out whether they really apprehend the principles as they are given. This will enable you to find out just what you want. I teach the subjects of Operative Technics and Operative Orthodontia, both. At the close of the first year they have finished with me, and I examine them for progress, each one of them; the Juniors upon operative dentistry, and Freshmen upon prosthetic dentistry. I do it, not so much to cover the whole range of subjects, as for the purpose of finding out whether they have been diligent in attendance upon my lectures, and also whether they know exactly what is going on; in other words, whether they are learning what I expect them to learn. I try in my teaching to inculcate principles as much as possible. Of course, the details we have to deal with. We can-

not ignore them, but over and above that we have to teach principles. If we can get a student to understand the principles involved in any particular process or operation, we know he understands the rest. At any rate, his mind is in such a condition as to more readily grasp the details, and to have a better command when he has to do an operation or speak about it. When I quiz students at the end of the junior year I have them before me. I start out on the subject in which they are to be examined. They are examined again at the end of the next year. I pick out points to see whether they understand them. The manner in which I do that is to stand before them and ask a number of questions.

One of the simplest things we have to deal with in prosthetic dentistry is the nature of materials students are going to use, and I feel, first of all, that as they are going to use Plaster-of-Paris they ought to understand a good deal about it. Of course, I question them in regard to other matters, also, but taking that as an example, I will first start with one man in this manner.

You know what Plaster-of-Paris is? Can you tell me from what it is derived? He answers by giving me the name of the rock—gypsum. How is it obtained from the rock? He tells me how it is ground out, dehydrated, and so forth. He tells me the process of doing it, and so forth. Before that I ask him what is the chemical name for Plaster-of-Paris? He gives the chemical formula, and then I go into the preparation of it, asking him how it is prepared, and he tells me. I say to the student, this Plaster-of-Paris is ground from the rock into powder, and prepared for use in the way you have described. When I mix water with the power, what takes place? The student will say it becomes hard. Do you know why it becomes hard? No, he does not know exactly why it becomes hard. If he does not know that I say to him, you have not attended my lectures. You have missed something. I go to the next student and I ask him what is done when Plaster-of-Paris is prepared. He perhaps tells me that water is driven off, and I say I never saw any water in Plaster-of-Paris. Finally, I say to him, why is it that when you offer it water it takes it up? The student catches the idea, because it has been deprived of water and wants to get the water back. That is correct. Why does it become hard? Probably the student will tell me that the plaster in taking water endeavors to return to its original state; that is to say, it tries to get back to what it was in the beginning. I ask the question, does it become as hard as the original rock? It does not. Why does it not get back to the form of the original rock? Perhaps that is a stumbling block to him. In

other words, that the plaster cannot become rock, simply because it gets water. The calcium sulphate, etc., are in different conditions from what they were in nature. When nature formed the rock it formed it by a slow process of crystallization. This process we cannot imitate, because we have not the time and power. In a certain way we have changed the character of it, but it gets back as nearly to that as it is possible. You know that when you buy plaster and add water to it it sets quickly. I ask the student, why does it set quickly; why does it not set slowly? It teaches them to think of somethihg they have not thought of before. Then you say to them, suppose plaster is kept in an open box, does it set as quickly as in the beginning? This sets them to thinking again, and in that way you bring out little by little just what a student knows and what he does not know. You find out where he has failed, either from not attending your lectures, or failed to understand what you have been talking about.

Taking another subject, I question them sometimes on solders and soldering. I say to them, Mr. So-and-So, you have a piece of eighteen karat gold plate, can you flow a piece of eighteen karat solder on that plate? Perhaps he will say yes or no, and in either case he might be right. So far as he himself is concerned, I say you can flow eighteen karat solder upon an eighteen karat plate, and he perhaps answers, we are taught only to use sixteen karat solder on eighteen karat plate. That is so. Let us examine into the matter of what is eighteen karat plate. Well, he says, it consists of eighteen parts of pure gold and six parts of alloy. What is that alloy? It may be silver or copper, whatever is used in the formula. What is eighteen karat solder composed of? He hesitates a little, and finds that if it was the same it would be called plate and not solder. There is the difference. What is the difference? He thinks there must be something else in it. Suppose there is something else in it, what is that something else? He gets on to it. Possibly it is a little zinc. What is the zinc put there for? It is put there to bring about a lower fusing point. Why does it bring about a lower fusing point? Perhaps he does not understand that question. If he does not then I will say to him, Mr. So-and-So, you have not been paying attention to my lectures, or, you have missed the lecture when I covered that part of the subject. This teaches him to think and to reason out the facts I want him to get hold of, and makes an impression upon him so that he will remember it. After that, in regard to the further matter of soldering, I say to him, why is it that when you try to solder gold

plates, in the act of heating it you find a hole suddenly develop in the plate? What would that be due to? Due to melting. It might be due to a little zinc in the die. After a few more questions along this line I finally get the idea impressed upon his mind that he understands the law governing the mixture of metals. He understands the law that when one metal of a lower fusing point unites to one of a higher fusing point, the alloy is always the result of the higher metal. He has learned that. He understands that the gold is heated hot enough to fuse the tin, that they form the alloy, etc.

Then, another point in regard to fluxes. I say to students, what do you use borax for on a plate and solder? The general answer is that it makes the solder flow. I say to them wait a minute. I do not know about that. You say it makes the solder flow? Yes, sir. Would it not flow without it? No. All right You call it a flux, do you? Yes. In the first place, let me tell you that I do not think it makes the solder flow one bit, and in the second place, it is not a flux in the strict sense of the word. I will tell you what borax does. Why is it that when you make a silver plate in the laboratory, or make it of copper or brass, you do not have it nice and bright? Why is that? It is oxidized. How oxidized? Well, by the air. Yes, by what in the air? Finally, I get out of him that the oxygen oxides the plate. It forms a layer to cover over the plate? Yes. Just as ice covers water when it is frozen? Yes. If that is the case, how are you going to get your solder, or gold, or anything else, to unite with the plate? I say to them, suppose I have two pieces of soft wax and I put a sheet of writing paper between the two, there is interposed a substance there, that is what oxidation does—it forms a layer of foreign matter between the two substances that you want to unite. If you melt borax what becomes of it? It fuses. Yes, it does that, and in fusing what takes place? It cleans the plate. Well, partly, yes. Does it do anything else? They do not think it does. Is there not a little grease or dirt on the solder? Does it take that off? Yes. Is that all it does? They suppose it does clean the plate or solder, partly. Is that all it does? Well, finally you get out of them that it forms an artificial covering to protect it from the air; that if the air does not get down through it does not become oxidized. Metals too hard to unite their surfaces must be kept clean. They understand that if you apply borax it is to keep the air off, and that the metals are united by virtue of their affinity.

Those things are of importance to students. I insist upon hammering away at students to see whether they are capable of

reasoning out these things. Sometimes I may omit some little point, and a student, if properly trained, may supply it by his own reasoning.

In the matter of vulcanite, it is subject that students very frequently stumble over. It is singular, but the other night I wanted to see what proportion of carbon and hydrogen different authorities on the subject of vulcanite gave. I took the latest edition of Gorgas and failed to find anything about it. I took down the latest work of Essig, and he did not say anything about it. Former editions of Gorgas did, but the last edition (I think the thirteenth) said nothing about it. I want students to learn what takes place. It is easily told them. I want them to know why and how it takes place. If they do that in the other way they are simply memorizing, nothing more. When we come to that subject I say, Mr. So-and-So, you have made a rubber plate in the laboratory? Yes. What did you make it of? I made it of rubber. Where did you get the rubber? I got it from the stock-room. Why do you call it rubber? Is that correct? Well, he says no, not exactly. What is it composed of? It is composed of caoutchouc. Anything else. Yes. It has coloring matter in it. Yes, that is all right. Anything else? Well, it has sulphur in it. Yes. You say that this piece of hardened rubber which I have contains caoutchouc and sulphur? Yes. Where is the difference? It does not contain any coloring matter. There is a greater difference than that, and what is it? Why don't you call it vulcanized or vulcanizable rubber? What do you do with it? I vulcanize it. Yes. What is vulcanizing? Well, it is heating substances some way or other until they become hard. That is something like it. I would like you to tell me how it becomes hard, and why? Suppose I do not know, I want you to inform me how it becomes hard? You told us in the first place that it was composed of caoutchouc and coloring matter, etc. Tell me why, when you heat it, it becomes hard? It is on account of the sulphur in it. Is the sulphur put there for that purpose? Yes. That is all very well. You have sulphur in rubber, you heat it, and the rubber becomes hard. How does it become hard? Some times they do not make themselves clear on this point, and then I say to them, when you apply heat to the material, what takes place? Does the material become hard right away? No. It stays soft for a while, becomes hard after a while. Perhaps I try to get at the answer a little differently. I will say, the sulphur escapes. How do you know the sulphur escapes? Well, the student says, I can smell sulphur when I open

the flask. How does that make the plate hard, if it gets out again? I tell him no; there must be something else. I say to him, when you said you smelt sulphur did you really smell it or some other gas? He probably answers that he smelt sulphuretted hydrogen, or he says it is mixed sulphur and hydrogen. Where does the hydrogen come from? It comes from the water This is a common answer, that the hydrogen comes from the water. I say, wait a minute. Do you believe sulphur is capable of separating the elements of water so as to take hydrogen away from the oxygen? No. Do you know in what way water can be resolved into elements, how hard it is to do it? You ought to have learned that in your lectures, and let me tell you that it could not possibly come from the water. Where does the hydrogen come from, then? The student answers this as well as he can. Can you tell me what caoutchouc is composed of? Well, it is gum. Yes. Does it belong to any peculiar class of vegetable substances, distinct in themselves? Well, yes. Hydrocarbon. What is a hydrocarbon, and what are the elements composing it? He answers these questions as well as he can. The first thing is, does the idea suggest at all that hydrogen may be gotten from some other place except water? It comes from the rubber. Now you are getting on the right track. He gets that clearly into his head. Why is it that the plate becomes hard? You put in sulphur, the sulphur is united with the hydrogen, and he may make it clear to you that he understands the subject. When you speak of hard rubber, it is not rubber at all, it is entirely changed. It is what is called vulcanite.

And so, gentlemen, with a great many other things, I give little illustrations, trying to bring out what the student knows about different subjects. whether he understands the different steps, as I explain them. If he is ignorant of certain points I try to enlighten him at the time of the examination. Very frequently in these examinations, I can impart to students instruction regarding some points in which they were lacking. In speaking of these little points today, I have done so with a view of trying to get other members to bring out their methods of examinations or teaching.

Dr. N. S. Hoff, of Ann Arbor, Mich.: The subject we have before us this afternoon is in the nature of an innovation, as it was intended to be. Some of us believe that there is a technic of some other things besides dental anatomy, and we are making an effort to introduce the technic of other teachings. Dr. Guilford has beautifully and comprehensively outlined the manner of presenting this subject to the Association. I shall consider briefly my own work.

I teach, in connection with other work, Materia Medica and Therapeutics in a lecture course, and have found the greatest difficulty in presenting a given subject to my class, because of the lack of a proper text-book. There is no satisfactory text-book on this subject. We have a number of books that are suitable for reference, but I have not been able to find any book that I could satisfactorily follow in teaching materia medica and therapeutics. I make my own classification, and it corresponds with no text-book that is published. Of course, students take notes, but oftentimes I find they are not taking notes, showing that I am talking too fast for them, or they do not catch the ideas. In the quiz exercises and written examinations, which I hold at stated intervals, I find that the students have not grasped a subject as I intended they should. Perhaps I did not present it sufficiently clear for them to understand it. I have cast around for various schemes to help me out. I have thought of making a syllabus of my work and presenting to the class an outline of the lecture that I give on that day, this syllabus simply giving the salient points of the lecture, thus placing my notes directly in their hands. I have not yet done this, but it is what I have in mind and hope to do. Until I can do that I have adopted the plan of instituting a quiz at the beginning of the lecture, taking as much time as may be necessary to carry it on. Sometimes this quiz will last half an hour, depending upon the interest developed by the students, or the difficulty I have in clearing up the subject. The quiz is not presented to a student here and there that I think will answer or cannot answer. My object is not to trip up somebody. I quiz two men each day, and they know beforehand that they are going to be quizzed on that day. I quiz from an alphabetical list, and every morning the first part of my work is devoted to a quiz. The students also know on what subject they are to be quizzed. I go into the lecture-room, and after calling the roll, they are called up one by one and quizzed regarding the lecture of the previous day. Each one is quizzed with reference to the salient points in that lecture, but not so much in detail as Dr. Guilford has indicated here today. In conducting a quiz I have been a little surprised at the interest manifested by the students. I have, in a manner, disarmed them of all suspicion, because I am perfectly frank with them. The student has no suspicion that I am going to give him catch questions. I ask him only such questions as pertain to the subject I have presented, and which lead up to the exact thought I have presented; but of course I do follow exactly the same order at the lecture. I try to draw out the practical application. If any one has a suggestion to

offer he presents it after the quiz is over, so that we may have opportunity to explain or elaborate it. In this way I have been surprised to see, not only the interest students take, who are to be quizzed on that day, but the interest of the entire class. Every member of the class is anxious to see how well the students will answer questions. There is a spirit of emulation in this matter that has been quite a surprise to me. Personally, I feel that better work is done, and the whole class gives better attention. The students do better work than if I were to call up a man here and there, as by accident. Every two weeks we have a written quiz. I take the lectures we have gone over during the previous two weeks, and I give each student a single question, or perhaps two that are closely related one to the other. For instance, how is heat therapeutically administered; and perhaps the other question, what is the dosage of heat for local stimulation? The two questions are so related that the student's thought will be concentrated on that question alone. Every member of the class is asked questions in a similar manner, but not the same questions. These questions are written at the top of a page in a small blank book, which I furnish, and the students are instructed that they must not cover more than one page in their answer. I want them to think long enough to answer questions briefly and accurately. There are all varieties of answers to the questions. Each man answers his own question on his own responsibility. It usually takes anywhere from fifteen minutes to half an hour to hold a written quiz in this way, after which these books are handed to me. I show you one of the books here. I take them home with me and go over the answers and mark the errors. I do not write what the error is. I simply put a mark around the word he has misspelled, for instance. Possibly I may put a question mark or something on the margin of the page to call the attention of the student to it. I place in the margin a grade mark of what I allow him for that answer. On the outside of this blue book is the student's name, and below it will be his grade mark. This same book is used by the student at the next examination. Upon the next page he has another quiz exercise, and two weeks later another one, and so on. In the middle of the term, or at the end of the semester, we have a written examination, in which I have six to ten questions for the whole class. The final examination is recorded in the same book. These books will be returned and kept by me, and I have each man's quiz record. I shall have these bound in some form of temporary binding, and file them away. In this way I have each man's examination paper, and record, for the entire year. So

far as I have carried out this method, I have found it an excellent one in getting at what the students know, and getting at it in a fair and honorable way. I sometimes make a comment on their handwriting, or spelling, and subsequently I find they take more care. I believe in this way I present my work in better shape than I could otherwise do, and I get a more thorough and systematic quiz examination than I could get in any other way.

Dr. Wm. E. Harper, of Chicago: The suggestion made by Dr. Hoff is an excellent one. I stated this morning that I was dissatisfied with results gained by drawings in the study of dental anatomy and the internal structure of teeth. I suggested to Dr. Weeks, that in the future, instead of having students make drawings of the pulp chamber, root canals and structures of the teeth, I was going to ask each student to write a description of what he sees, covering the diameters of the canal, proportions, thicknesses of the different walls and of the different structures, and Dr. Weeks said I would have more than I could possibly do in examining these papers. It occurs to me, with a book somewhat similar to the one used by Dr. Hoff, I could examine the books of students at any time during the term, and that I would be able to find time to get around to the papers of the entire class. In this way, I believe I would get better results, or a better understanding of what a student sees than I would by drawing, and so I propose to adopt his book for that work.

Dr. Fred B. Noyes, of Chicago: My part of the subject has been dental histology, microscopic structure of the dental tissues, and in our course of dental histology which we give to the juniors we try to develop the structure of the teeth with especial reference to operative procedures; then a study of the enamel rods and their directions in reference to the teeth as a whole and their relation to each other form one of the most important parts of this work. I have found it exceedingly difficult to convey to students ideas of relationship and direction of enamel rods. The rods themselves are so very minute that with the training which our students have in microscopic work, it is difficult for them to attain ideas of the relations of those rods to each other in three dimensions of space which we wish them to get. If I give them ground sections of teeth to study I can demonstrate enamel rods. I often fail to have students grasp the idea of their relationship; I give them a section in which the enamel rods at the outer surface are parallel to each other, but deeper down the ends of the rods are twisted, running around each other. In the section the rods at the outer surface appear parallel to each other. The inner ends of the rods are twisted around each other.

I demonstrate this point with clay models. This clay prism represents the enamel rods in the outer portion of the tooth. These rods are arranged so that they are parallel with each other (illustrating with soft clay), but at a certain depth they no longer continue parallel, but are twisted around each other. If I have a section cut down, and I have a large knife to cut with, at the deep portion I will have one place where my rods are cut crosswise, and in the other place where they are still cut parallel with each other. In this way we can illustrate the appearance of a section, so that the student gets an idea of these relationships. I tell him that practically those enamel rods will cleave under the chisel as far as they are parallel with each other, and from there they will break as we often find in working. A chisel applied to the surface cleaves the enamel rods off like that (indicating). The teeth cleave only as far as they are parallel with each other; when they begin to twist upon each other they will break off at that point. Then, by the use of models, I can arrange the rods on the surface so as to get their direction. Here we have their relation to the margins of cavities, showing at that point (indicating) the rods would be running in this way, necessitating the beveling outward of the margins in order to keep them from having the inner ends of the enamel rods cut off as they would be if we now cut straight down through here (indicating). To illustrate these points I have a large board with the outline of a tooth on it; on it I can arrange these clay rods with the enamel so as to give their direction over the entire surface of the section in a way which the student cannot get simply from the study of microscopic sections. If he studies gross demonstrations, when he comes to his microscopic sections he thinks he understands the appearance that he gets, but without that he often fails to appreciate the meaning of what he sees under the microscope. You can prepare enough enamel rods to build every section or the whole of a model. You can build the entire outer surface with such clay enamel rods, and then you have it for your demonstration. With a large knife you can cut through it and show what appearance you would have in microscopic sections cut in that direction. This clay is not ordinary modeling clay, it is composition clay, which is not moistened with water, and the advantage of it is that it stays plastic, does not dry up. If I have time today, for example, to prepare my model for a lecture next week, when I come to my lecture time my model is as perfectly plastic as it was when I finished it. The use of clay for purposes of demonstration is not confined simply to the demonstration of these enamel rods. I use it continually for demonstrat-

ing other things. For instance, I use it in demonstrating the directions of the fibers in different portions of the peridential membrane, using smaller threads of clay, modeling out the surface of the root in half relief on this large modeling board, and then the alveolar wall, and stretching across these threads of clay are used in the same way, giving ideas of directions of these fibers of the peridental membrane. In general histology I use it also, and in the development of the enamel organ from the dental ridge. The way in which these twisted enamel rods can be demonstrated is easily shown and appreciated, and the cleavage of enamel under a chisel is more perfectly illustrated by these clay chunks than by anything that I know of. If I wish to apply a chisel in this direction (indicating) my enamel rods split off in this way, and when I have a larger mass of clay than this to work on the rods bend over to this point (illustrating) and the twisted rods break right off there.

Dr. Otto Arnold of Columbus, Ohio: In considering technics in didactic teaching, I will briefly refer to a method which was adopted in the Ohio Medical University which I have the honor to represent. We use almost exclusively the recitation plan for this purpose. We have small rooms distributed throughout the building which brings the teacher in close contact with the students, and limits the number of students in each class to forty. We do not have more than forty students attend recitations at one time. If the class is larger the students are divided. You can readily understand that this brings the teacher into closer contact with the students. There is no intimidation at all; everything is straightforward and open. Of course, we select a standard textbook. We have various books which we think a good deal of, such as Gorgas, Black, Marshall, and others and we assume that the writers of these various books know more about the subject dealt with than do the teachers, unless they are renowned men, and of course there are many of those in the dental profession. We do not believe that we are above the average; we believe that the authors of textbooks know more about the various topics than we as teachers. The topics we study are assigned. For instance, today at my recitation I have dealt with a certain topic and finished it. There is a topic given out for the following recitation, whatever it may be, and I take a textbook, such as Gorgas, or the American textbook, and figure out the number of recitations I will have for the whole year. In round numbers I have fifty recitations. I look the book over carefully and divide my subjects, so that I have about fifty recitations for the class. There are some things in the textbook that I may not wish to talk about. For instance, in this

book there is a valuable contribution on miscroscopic anatomy of the teeth. We are using Black's Anatomy as a textbook. That comes under the head of dental anatomy in this book, so that I do not use it at all. I select fifty recitations out of that one book. Having finished my recitation today, a topic is assigned of so many pages for the next recitation. The students are expected to study it; they do study it, and they know just what they are expected to be quizzed on. Every recitation is a quiz. We do not lecture at all in the sense of talking for an hour. We have discarded this. I meet my class at the following recitation and begin at once to ask questions. My questions are formulated entirely to correspond with the topic under consideration. I do not go beyond it in my recitation. I proceed alphabetically, and try to arrange so that every student has something to say. The time consumed in the recitation is about an hour, or in some cases it may not be over fifty minutes. I supplement that fifty minutes with a talk, which might be construed into a lecture, talking a little about this and a little about that point, commenting here and there on points spoken of in the textbook. The advantages we have found from following this plan have been that, in the first place, we have a good attendance; every student is expected at every recitation to be called on, and he does not know what questions he will be asked, so that he studies the whole topic. I may ask him questions at the beginning or end of the recitation. I do not take the list of students alphabetically and follow it, but I sometimes begin with a student in the middle of the list of names so as to change the order in which their names are given. In this way they will not anticipate the time when they are to be called upon to answer questions The advantage of the plan is that it has given us a good attendance. Another advantage is that they do study their lessons. This method is followed in the whole institution, in the medical as well as dental department. In the final examination or final marking we know the standing of each student daily from his recitation work. If a student does not answer questions correctly he is marked accordingly, so that I can tell at the end of the year the standing of my students. I commend this method to all of you.

Dr. H. A. Smith, of Cincinnati, O.: This is a very important subject. I have been waiting for years to listen to the different methods of teachings. Dr. Guilford struck the keynote in his first remark relative to clearness of speech. A great many teachers fail owing to lack of clearness in speech. My criticism on teaching is that we do not speak loud enough as a rule. The articulation

is imperfect. Dr. Guilford trained himself in the beginning; he began a long time ago. I have not been so enthusiastic, and have not yet learned the art of public speaking. Why is it that in some of our schools the students attend lectures *en masse* when some of the professors are going to lecture, and when other lecturers are to follow, as soon as the bell rings they sneak out? It is because some of our professors are not good speakers. The American is a bad speaker. If you go to church much and visit different churches, you will find there is not one minister in twenty-five who speaks well; hence the congregation goes to sleep. As far as good speaking is concerned, I think the average American minister is a reproach to religion. Are we not doing the same thing? I think so to some extent. If you want to be understood, speak to students understandingly and in sufficiently loud voice so that they can comprehend every possible syllable. Dr. Guilford is my ideal of a teacher. He not only speaks well, but presents his subject consecutively. His text-book on Orthodontia is a model in my judgment. So difficult a subject as that is treated in his book in a consecutive manner. It is a model in that regard, and he must be that kind of a teacher. A teacher must talk to students consecutively; he must stick to his text, except when he wants to illustrate it by recalling some personal experience. This leads to another point. The recitation system is undergoing a trial. I think the text-book system alone is unsatisfactory. I overheard some female students the other day discussing a lecture which they had heard. One of them said "Now, Doctor So-and-so gave a lecture to us like it is in the text-book. We can read that." Then, I heard a comment on the lecturer, who is a good speaker. A man who talks on a practical subject is expected to relate somewhat his experience; if he has not had any he might invent occasionally. The man who has no practical experience cannot tell students much outside of the text book he uses. Text-book writers do not know it all, so that the teacher should give his personal experience occasionally as well. As I have said, the text-book system of recitation is on trial. My own conviction, however, is that both systems are good.

Last year I gave a lecture on diagnosis. I met one of our students, an intelligent fellow, and asked him how a lecture of that kind struck him, and he replied: "We want something on general diagnosis and special diagnosis; we cannot get it out of any book." He is a good student, and an extensive reader. This was the way the lecture impressed him.

The matter of finding out what a student knows is exceedingly difficult. You doubtless remember what Huxley said about that. I have had some experience in dealing with raw or crude material, particularly when I became a teacher in a dental college. Huxley said that "the art of examination was one of the most difficult of attainment." This I can corroborate from long experience in examining dental students. Here was a remark that was made by one of the shrewdest and most accomplished scientific men of our time. Are we expected to solve that problem?

Dr. Hoff mentioned his manner of giving two students a quiz on a known topic. That method has its excellencies, of course, but there are objections to it. The majority of dental students mean business and are studious. I have no particular method to suggest at this time. This year we inaugurated a mid-term examination; each class is examined by each professor in his subject. Just before I came away to attend this meeting I was wrestling with these papers. They were good, bad and very bad. I was much amused at one question. What are the objects in filling teeth? A student answered the question in this way: "The objects of filling teeth are, first, to arrest decay, and second to prevent its recurrence." And that covers the whole bill. Two students answered in this way: "The object in filling teeth is to retard dental caries." That is what a great many dentists are doing, simply retarding it. I said to them, Professor Black answers that fully. The objects in filling teeth are only two, namely, to arrest decay and prevent its recurrence. That is all there is in operative dentistry.

Now, the reason we are trying have a mid-term examination is for the purpose of finding out what students know, and we find some do not know very much. I claim that a busy man like Dr. Guilford or myself cannot quiz students sufficiently to know what they have learned. This work must be relegated to the quiz-master, and the difficulty is he does not know what you have been talking about. If I could devote my entire time to teaching I could do that effectively. But I cannot afford to do it Quizzing students is drudgery. We do not know as yet which is the best system to adopt; we are all at sea about it. We must either quiz students, have written examinations or have a quiz-master. The teacher must talk to them plainly and in a distinct tone of voice, properly enunciating his words, and in a consecutive way, and know what he is talking about.

Dr. Hunt, of Indianapolis: Dr. Smith said that the recitation system was new in dental work, and that because we know it is new

it is on trial. Let me say that it has had a thorough trial and has proven to be very effective. If we had better text-books, in my opinion, it would be the only method of teaching in the lecture room, that is, it would be in any college in which I could control the matter. In physiology, in anatomy, in pathology, since Burchard's admirable text-book has been issued, and in operative and prosthetic dentistry, since the American text-books have been issued, I believe the recitation system of teaching is the true one. I believe if lessons are assigned and the class quizzed just as we were quizzed in our childhood, and as it is done in our public schools, the best results would be attained.

In regard to examinations, it is my opinion that the only way we can ascertain the amount of knowledge a student possesses upon a certain subject or subjects is by oral examination. It is true, it takes time and a great deal of trouble, and the professor does not like it, neither does the student, but you can ascertain the extent of a student's knowledge better in this way than by any other method. In our college we have been trying in two or three departments to hold examinations, taking five minutes at a time, asking each student from ten to twenty questions. If a student fails to answer the first ten questions he is given ten more. If he fails to answer any of these he is told to go, and come later, when he is given twenty or perhaps fifty more questions until the teacher finds out what he knows. A great many students get badly rattled, but if the professor handles them correctly, as he should try to do, he can overcome their fear and nervousness and will soon find out all they know.

We have had midwinter examinations for years; we had monthly written examinations one year but the labor was such that we had to give it up. We now hold two examinations yearly.

Dr. G. V. I. Brown of Duluth, Minn.: The central idea in Dr. Guilford's remarks was to make a student think for himself rather than to drill into him certain things which he wanted to know. He is not only to study and learn, but also to think. A good deal has been said about the use of syllabi in courses, and I have had a little experience with them. When I became connected with the Milwaukee school, in the medical department they had begun to some extent to make use of complete notes of the lectures for the year, of which mimeographic copies were made and distributed among students, so that the students could follow the lectures through. One of the teachers in the dental department had adopted that system. When I looked at it, I thought it was a good deal like masticating the food for the student a little too much. What we want is to make

students think. There are different systems that may be adopted for teaching various subjects. We may, if necessary, slightly modify them. I have prepared a list of questions from Dr. Marshall's recent book, at the end of each chapter. But we wanted something more. I make lists of questions not only of what I am to lecture upon but covering such points a little outside, but which will require them to think. The questions are put in a book, and the students look the answers up for themselves. They are to give the answer in the space below the question. This gives each student practically a quiz compend of his own. I am able to ask them as many questions as they can conveniently look up. Any student who takes the trouble and pains to look up answers to the questions will remember them in all probability, and he is instructed to give his answer in a concise form.

Dr. J. D. Patterson of Kansas City, Mo.: Whatever may be said of the recitation method of teaching, in the branch which I teach, that of dental pathology, it is certainly very important. The trouble in teaching dental pathology is that we have no textbook, notwithstanding Dr. Hunt thinks Burchard's book is all right. Personally, I am not satisfied to teach students pathology from any one textbook. I gather my questions from the American textbook, from Dr. Black's articles on pathology, from Dr. Senn's Principles of Surgery, from Dr. Marshall's recent book, from Burchard's book, and from Ingersoll's old book. For years I have systematized the different subjects which I desired to teach in a fairly satisfactory manner. I have been, as no doubt most of you have been who have taught pathology, confronted with this situation from year to year. In my former lectures I have had students come to me and say, "Professor, you said so and so, and now you say so and so." I answer the question, explain the matter in a manner to obviate confusion. I think it is desirable to follow the plan which I am now following. I have all of my lectures, except the ones which I desire and compel students to be up in, in one book, numbered from one up to fifty or one hundred pages. I have another duplicate book in which are questions numbered the same. Every question has a corresponding number in my lecture book, so that I do not confuse students in the way I have done in the past. In this way every question upon general pathology is answered in the one way in which I have formulated it, the best answer from all the authorities I have consulted. I do not confine myself to one authority. In addition, I have didactic lectures in which I relate my own practical experience in connection with the observations of others. In addition to the list of questions

the answers to which appear in the written lectures, I have questions about which so much that is important is unknown. Even if a student does answer a question perfectly, does he understand what the answer comprehends? So I have a number of questions supplementing each one of my lectures. I may ask a student to give a certain pathological condition of the tissues of the mouth. I ask him to describe one in which it may be brought about, giving the changes from healthy function up to impaired function. By asking such questions I find out what he knows. It is particularly important in teaching the subject of pathology. All the questions that are required in the final examinations in my branch at the end of the junior and senior years are in my notebooks. This year, the exact answer I may want expressed differently, but it comprehends the same thing. Each question and answer have the same number, and I can refer to it at any time.

In regard to quizzes in the recitation room, the thing for the lecturer to do is to gain the attention of his students. He can never do this unless he is interested and enthusiastic himself. Personally, I claim that I am enthusiastic, and that when I conduct a quiz the students know .it, and when they know it they will give you their attention. I have adopted a method this year that I have not used heretofore. We have our books printed. I have a book for the roll call, another for the quiz. I mark the man I have quizzed and how he has answered. I have two books for that purpose. I call a student by name and require him to stand up, not sit. It is my desire that the whole class shall see him. I pick a senior out, covering the list. I call, perhaps, Mr. A. He stands up, so that everybody can hear; he commands attention; he is compelled to talk loudly. If he does not speak loud enough he is asked to repeat what he had previously said. It is a little embarrassing for students at first to stand up and answer questions, but it is a most admirable plan.

Dr. N. S. Hoff, of Ann Arbor, Mich.: My experience with students has been that when they have heard a course of lectures on any subject, although it may be essentially changed you cannot claim their attention as well as you could the first time. I am aware, that Dr. Patterson has the advantage over most of us in this respect. He knows his students. The secretary of a faculty knows the students personally. Dr. Patterson is a man of strong personality and can command both the attention and respect of his students much more so than most of us would be able to do. I am convinced, however, that when students are compelled to take a course

of lectures the second time they do not give the same attention to the lectures if they know they are to have a second opportunity.

I have never taught pathology. I imagine it is a very hard subject to teach. I feel that the repetition of a subject is rather detrimental than beneficial.

Dr. J. D. Patterson, of Kansas City, Mo.: In reply to the last remark of Dr. Hoff, I have not found it so. It may be because my lectures this year are not the same as last year. My lectures are new; they are up to date, so that repetition is not old and stale with the students.

There is one point I wish to speak of, and that is the written examinations I give at the end of the junior year. When students have failed or are marked low, I take the papers at the commencement of the senior term and show them to the students, make it open to everybody. I call a man's name, and I ask him, "Why did you answer this question in the manner in which you did?" It is wrong, and I wish him to know why it is wrong. It is a good method of teaching. In the written examinations we have every year we take up the questions in which they have failed and show them the mistakes they have made.

Dr. G. V. Black, of Chicago: Systematization in lecturing is a good thing. I have the impression that perhaps there is too much of it done. Usually I go to the lecture room prepared with a subject, and I take it up at the next lecture where I left off. This is the method I follow from beginning to end. Usually my course is not divided into lectures. I may change my subject in the middle of the hour. If I finish a subject in the middle of the hour, I take up another topic, giving a consecutive presentation of it. My subjects are all arranged consecutively. If I talk on the subject of dental caries, I follow it with diseases of the dental pulp, introducing with dental caries, first, hyperemia, inflammation, suppuration, on to destruction of the organ, alveolar abscess, and so on from the diseases engendered by caries as the starting point. And so I pursue all of these subjects on pathology throughout my course, presenting them consecutively as they occur. At the end of the year my notes are put away. With the beginning of the next year the subjects are made new entirely. The old notes are no good. If one's lectures are written out carefully they may be preserved for use another year. I think it better, however, that the notes be destroyed and the subject taken up practically *de novo*. Of course, the standpoint from which the subjects are presented will be very similar, but they will be presented in different words, perhaps a lit-

tle different in order, but not much. The nature of our subjects does not permit much variation in the order of presentation. When subjects connected with dentistry are presented in consecutive order students should recognize it, and should understand that they cannot very well miss a lecture. If they miss a lecture, it is not the lecture that they drop out, but it is the part of the subject being presented.

Dr. George E. Snow, of Buffalo: Our didactic teaching must be supplemented by quizzing, and this should be done by the professor. If the quizzing is left to a quiz-master the professor is not sufficiently in touch with his pupils, and he does not know exactly what they need. Then another point is the student to be quizzed. It is not the bright student who answers a question the moment you ask him one; it is the dull one that must be spurred up, and there is nothing better in my opinion than a good quiz. Students take pride in it, and they are brought closer to the professor and are made to take hold of a subject and comprehend it better.

Executive Board's Report by Geo. M. Wilson.

Operative Technique.

Eighteen schools reported, as follows:

Louisville College of Dentistry.
Royal College of Dental Surgery of Ontario.
Western Reserve University, Dental Department.
Indiana Dental College.
Philadelphia Dental College.
University of Tennessee, Dental Department.
Vanderbilt University, Dental Department.
Pennsylvania College of Dental Surgery.
Ohio College of Dental Surgery.
Kansas City Dental College.
Northwestern College of Dental Surgery.
Northwestern University Dental School.
Chicago Dental College.
Columbian University, Dental Department.
Baltimore College of Dental Surgery.
Western Dental College.
University of Michigan, Dental Department.
University of Minnesota, Dental Department.

Question:—How do you teach tooth form, surface and surface markings? (Didactic, recitative, models, drawing, actual teeth or other appliances.)

Seven schools utilize five of the models, one of which adds carving, and one actual teeth from early child life to old age.

Two schools, all the mentioned ways but modeling. One school, modeling, drawing, actual teeth and carving. One school, recitation, modeling, drawing. One school, lecture, actual teeth, carving. One school, lecture, modeling, drawing, actual teeth. One school, lecture, drawing, actual teeth, carving. One school, lecture, actual teeth, and lantern slides. One school reports, explanatory talks, nomenclature, definitions, etc. Study natural teeth, measure and draw two surfaces, enlarged three times. Model each tooth, upper and lower, one side, from measure, enlarge three times and recitations. Sixteen use lectures; eleven, recitations; twelve, modeling; fifteen, drawing; seventeen, actual teeth; four, carving; one, lantern slides.

Question:—How do you arrange for holding the teeth while filing, in pulp chamber and canal study?

Twelve schools use wooden blocks and attach with sealing wax; one, wood block and shellac; two, imbed in plaster; one, plaster and sealing wax; one, plaster and modeling compound; one reports, "Do not fill teeth outside of the mouth." One of the schools reports that they use a different kind of wood each year.—(A good suggestion.)

Question:—How many longitudinal aspects of pulp cavities do you expose in each tooth, and how many teeth does each student dissect?

Thirteen schools report two longitudinal aspects of pulp chamber exposed. Two schools report one each. In answer to the question "How many teeth does each student dissect?" three report two each. Two, eight each. One, ten. Two, eleven each. One, fifteen. Three, sixteen each. One, twenty-two, and one forty-two. One report, two in anterior teeth and four in molars. Each student is supposed to dissect one aspect of each anterior tooth and two of each molar. (When teeth are scarce, sections on file provided for study and copying.)

Another reports, "tooth is modeled in soap, cut longitudinally, pulp formed and canal outlined by fine camel's hair brush in red paint." One, "We follow Black's Dental Anatomy."

Question:—Do you have tranverse sections cut? If so, how many cuttings to each tooth?

Fourteen answer yes; six answer no. One school requires one section; four schools, two sections; three schools, three sections; one school, four sections; two, five; and three, six sections.

Question:—How many silhouette prints of each dissection required?

Four schools report none; one reports two; four report from four to six; one, five to ten; one, eight to twelve; one reports one print of each cut; one reports one sheet of each tooth; one reports "free drawing"; one reports seven each, of his own dissections, and also seven of each of the dissections of four other students; one reports "each student makes three drawings of every aspect of all teeth, longitudinal and transverse, according to measurements."

Question:—What color of ink used?

Five blanks, seven black, two lead pencil, one blue, two choice, one maroon.

Question:—Do you require the interzonal line between enamel and dentine to be shown in print?

Answered—Four blanks; six, yes; five, no; one, traced in drawings; one reports "part of them"; one, optional.

Question:—Do you make dissections and silhouette prints of deciduous teeth?

Twelve, no; six, yes; three of them modified by "when can get them," and one yes—drawing is substituted for printing.

Question:—Do you have trouble securing enough teeth for class work?

Twelve, yes; six, no. The Toronto school reports "no, we buy them, have some for sale."

Question:—What Dental Anatomy do you use as a text book, and is each student required to possess himself with a copy?

Fifteen use Black's only; one, Black or Boenning's; one, Tome's; twelve require the student to have a book; six, optional.

Question:—Do you have students draw pictures of surfaces of teeth, and, if so, about how many?

Thirteen, no; one, nine; one, twenty; one, thirty-two; two, fifty-eight. One reports "one picture by measurement, enlarged three times, of labial and mesial surfaces of every tooth."

Question:—What size drawing (length) and on what kind of paper?

Twelve, blank; one, approximate size of tooth; three, three times the natural size; one, two to three inches; one, five inches; one, eight inches. One uses white book; one, plain pad; one, kindergarten drawing paper; one, same as silhouette printing; and one, regular drawing tablet.

Question:—Do you have students draw pictures of dentine, enamel, cementum and pulp tissue, as shown under the microscope?

Seventeen, no; one, yes.

Question:—Do you have students make models of teeth in clay? If so, what size and how many?

Nine, no; two use plaster; one carve in bone; two carve in soap; four use clay. One models one of each tooth, upper and lower, one side, by measure, enlarging three times, using "Composite clay," a preparation which does not dry out. (Ask Dr. Weeks about this special clay.)

Question:—Do you use clay for purposes of demonstration before the class?

Ten, no; six, yes, two use soap.

Question:—How much time is given to the anatomy of the teeth, including silhouette printing, drawing and modeling, and in what part of the course does it come? (First, middle or last.)

The answers to these questions are so indefinite that it is impossible to give definite answers excepting from a few. Apparently this work is taught the first year in all but two schools, where it is taught the second year. It is probable the average time is from thirty to fifty hours.

Question:—Do you teach instrumentation? (Classification and naming of instruments.)

Four, no; fourteen, yes.

Question:—Do you have a list of instruments required for each student in operative technic work?

Three, no; fifteen, yes.

Question:—Do you have students make models of required or other instruments, in brass or other metals? (Pluggers, excavators, burnishers, etc.)

Two, yes; sixteen, no.

Question:—Do you teach cavity preparation? If so, how many and what forms of cavities, etc.?

All answers, yes. Four answer "according to Weeks' Manual." Otherwise no two alike. One says, all forms; one, number and variety limited by material at hand; another, general principles; another, not definite; another, thoroughly; another, too numerous to mention; etc.

Question:—Do you have students prepare cavities in extracted teeth or some other substance? (Ivory, bone, rubber, celluloid, metal alloy, or other composition.)

Nine, use extracted teeth; ten, rubber; four, bone; four, ivory.

Question:— What materials handled and how many fillings required of each?

No. 1. None except root canal fillings.

No. 2. Gold, amalgam, cement, four, tin, in imitation of non-cohesive gold.

No. 3. All materials, and as many fillings as may be necessary for the perfecting of each student.

No. 4. Tin, gutta percha, amalgam, and cement. About six of each

No. 5. Cement, two; gutta percha, two; amalgam, four; tin, eight to ten; gold, two.

No. 6. Gold, amalgam, and cement. Three to ten of each.

No. 7. Gutta percha, oxychloride and oxyphosphate cements, tin, cohesive and non-cohesive gold and combinations. No stated number.

No. 8. Gutta percha, cement, amalgam, tin, gold. Number indefinite.

No. 9. Tin, six; amalgam, six; cement, four; gutta percha, four.

No. 10. Tin, gold and plastics. No definite number.

No. 11. Gold, 6; tin, 20; amalgam, 20; cement, 10; gutta percha, 10; gold and tin, 10.

No. 12.

Seniors—gold, 20;	alloy, 20;	cement, 20.
Juniors " 15;	" 15;	" 15.
Freshmen " 10;	" 15;	" 15.

All in living subjects.

No. 13. Gutta percha, cement, both oxyphosphate of zinc and oxyphosphate of copper, amalgam, tin foil and cohesive shavings. The latter to represent gold. Not less than two of each.

No. 14. All plastics cohesive and non-cohesive tin. Twenty-four fillings (approved) required in zinc phosphate, amalgam, and gutta percha.

No. 15. Tin, { 10 cohesive. 10 non-cohesive. 10 beginning with non-cohesive and finish with cohesive. }
Amalgam, five; cement, 5; gutta percha, 5.

No. 16. Tin, amalgam, cement and gold. About fifteen or twenty in all.

No. 17. Tin, cement and amalgam.

No. 18. Tin, amalgam, cement, and gutta percha. From four to ten of each.

Question:—Do you explain to students in this course the meaning of any technical terms, and if so, about how many?

No. 1. All that are necessary to teach this work.
No. 2. Yes. Don't know.
No. 3. Yes; all that arise in the course.
No. 4. Yes; pathological, anatomical, etc.
No. 5. Yes; the few most commonly used.
No. 6. Yes; all used.
No. 7. Yes; about 100.
No. 8. Yes; approximately 175.
No. 9. Yes.
No. 10. The terms are explained in lectures by professor.
No. 11. Yes; about 100.
No. 12. Yes; I don't know how many.
No. 13. Yes; all operations are demonstrated first and all such things explained.
No. 14. Yes; about two dozen.
No. 15. Yes; give it up—not less than one hundred, any how.
No. 16. Yes; as many as occur.
No. 17. Blank.
No. 18. Yes; as many as I can get hold of—perhaps between fifty and seventy-five.

Question:—Do you teach the chemistry of the different tooth structures?

Yes, 10; no, 8.

Question:—Do you teach any histology in this course? If so, how much and with what facilities or helps?

Five schools report that a very little is taught in this department, but most of the schools leave it to the Histological Laboratory.

Question:—Do you teach any pathology in this course? If so, how much?

As the answers to these questions make it very apparent that many of the schools add to this report of technic course of study much work done by other departments, we will give the answers in full.

It is also apparent that in some of the schools, some official of the school has filled out the same, in place of giving it into the hands of the special teacher of the department, and he reports the work of the entire school.

No. 1. No.

No. 2. No.

No. 3. Yes. This school reports Prosthetic Technic from 9 A. M. to 5 P. M.

No. 4. As thorough and complete as possible.

No. 5. Pathological conditions of the pulp and peridental membrane.

No. 6. A little pathology is given of the common forms of diseases of the teeth.

No. 7. Yes. Dentine exposed to fistulous abscess. All stages between.

No. 8. Yes, by the chair of Pathology.

No. 9. Yes.

No. 10. General pathology to third year; special dental pathology to all classes.

No. 11. Done in the senior class in the Pathological Laboratory.

No. 12. Yes. This school in answer to another question reported sixty fillings, seniors; forty-five, juniors; forty, freshmen; all on living subjects.

No. 13. Have regular course in Dental Pathology, both didactic and laboratory.

No. 14. Answers the former question and this one together, as follows:

In Histology and Bacteriological Laboratory, both Freshmen and Juniors have full practical instructions. In Histology section cutting, staining, mounting and microscopic examination. In Bacteriology variety of microorganisms, their growth, reproduction, etc., sterilization, etc. Have twelve microscopes at present. Four hours weekly of work in Histology and Bacteriological Laboratory, two for juniors, two for freshmen.

No. 15. Enough for the treatment of pulpless teeth.

No. 16. Yes. The several affections to which the teeth are susceptible.

No. 17. That associated with pulp exposure and putrescent pulps.

No. 18. Yes. Full course in the pathology of alveolar abscess.

As the next three questions are associated and it is difficult to get the beauty of the answers separately, we will give the questions together, designated each A, B, C, respectively.

Question:—(a) Do you teach therapeutics in this course? If so, how much?

(b) How do you have students arrange teeth to represent dummy patients?

(c) Do you have students apply therapeutic remedies to supposed pathological conditions in teeth of "dummy patient?" If so, how many each?

No. 1. (*a*, *b*, *c*) No.

No. 2. (*a*) No. (*b*) fasten teeth by sealing wax to blocks shaped like dental arch. Fasten blocks to dummy wooden jaw, gives correct position. (*c*) No.

No. 3 (*a*) Yes. (*b*) No, live patient. (*c*) No, live subject.

No. 4. (*a*) Yes, incidentally, but to as great an extent as I deem necessary to a dental student. (*b*) Have great difficulty in obtaining teeth for this purpose; (*c*) No, but on the natural teeth I do.

No. 5. (*a*) Therapeutics of a few of the most common medical agents in use. (*b*) Plaster models. (*c*) Each student applies eight remedies.

No. 6. (*a*) A few. (*b*) Not arranged. (*c*) Yes, about twelve.

No. 7. (*a*) Yes; enough to cover the pathological ground gone over. (*b*) A row in a bar of gutta percha. (*a*) Yes, ten or twelve.

No. 8. (*c*) Yes. By the chair of Materia Medica, and Operative Dentistry. (*b*) In cast forms representing the alveolus. (*c*) Through the mock performance.

No. 9. (*a*) Yes. (*b*) Dummy articulator. (*c*) Yes.

Three superior, 1, 4, 6. Three inferior, 3, 5, 6.

No. 10. General therapeutics to all classes. Dental therapeutics also by Professor of Operative Department.

No. 11. (*a*, *b*, *c*,) No.

No. 12. (*a*) Yes. (*b*) Don't do it. (*c*) No, only living teeth in patient's mouth. We have plenty of clinics for this purpose.

No. 13. (*a*) No. We have a didactic course in Dental Therapeutics. Some remedies are used in the technic course, and their properties and actions explained. (*b*) Have given that up. Consumes too much time, and destroys too many teeth. Insert a few teeth in models mounted in Bonwill Articulator. (*c*) Not to any great extent, only enough to show technique of dressing, etc.

No. 14. (*a*) Two clinics weekly in therapeutics. (*b*) No. (*c*) No.

No. 15. (*a*) No. Except for treatment of pulpless teeth. (*b*) Do not arrange to represent dummy; but invest the teeth in plaster of paris. (*c*) Yes, probably about six.

No. 16. (*a*) Yes. All that is necessary to meet the several pathological conditions. (*b*) Take impressions of good denture, put crowns of extracted teeth in impressions and pour model. (*c*) Eight or ten.

No. 17. (*a*) Chiefly the use of astringents. (*b*) No.

No. 18. (*a*) These remedies only used to destroy pulps and the treatment of pulpless teeth. (*b*) In modeling compound, also use the rubber tooth forms. (*c*) Yes, seven cases.

Question:—Do you teach distinctions between different forms of alveolar abscesses?

Yes, ten. No, eight.

Question:—Do you teach methods in root cleaning and filling, and how many? If so, how much required of each student.

No. 1. Each student fills eight teeth and then cuts down with file to learn how well done.

No. 2. Yes, six teeth, filled with chloropercha, and gutta percha points. File same open afterward to see how well filled.

No. 3. Yes.

No. 4. Yes. One or more of every class of teeth.

No. 5. Yes. Fine root canal filling required of each student.

No. 6. Yes. One. About three of each class of teeth.

No. 7. Yes. (*a*) Changeable. (*b*) Eight to ten.

No. 8. Yes. The vexatious methods in common use. Each student fills the entire set of teeth.

No. 9. Yes. (*a*) Three. (*b*) One incisor, one bicuspid, one sup. molar, one inf. molar.

No. 10. Yes.

No. 11. Yes, 25 canals,—fill with gutta percha and lead points, with chloropercha. Afterward dissect both.

No. 12. Blank.

No. 13. Open and cleanse canals. Filling three models. In all, not less than six teeth.

No. 14. Yes. No special number. Enough to satisfy instructor that student has sufficient skill.

No. 15 Yes. Three methods. Each student fills the roots of eleven or more teeth.

No. 16. Yes, all of recognized value, 20 to 25.

No. 17. Yes, one accepted method requiring each student to operate upon at least one of the single-rooted teeth and one of the molars, upper and lower.

No. 18. Yes. From ten to twelve teeth.

Question:—Do you teach tooth bleaching in this course? If so, in natural teeth or in vegetable growths, with test tubes or beakers.

Sixteen, no; one in natural teeth; one in vegetable growths.

Question:—Do you teach methods of pulp capping and pulp devitalization? If so, how—by didactic instruction or actual application of drugs or remedies to tooth in dummy?

No. 1. No.

No. 2. Yes, didactic only.

No. 3. Yes; actual application.

No. 4. Yes; didactic and application.

No. 5. Yes; actual application.

No. 6. Yes; actual application.

No. 7. Yes; both.

No. 8. Yes; didactic and actual work in clinic room.

No. 9. Yes; both.

No. 10. Yes; on the patient in the clinic room, also by description in lectures.

No. 11. Yes; pulp capping; by application of remedies.

No. 12. Yes; but don't use dummy for anything.

No. 13. Pulp capping an application of devitalizing agents is taught. Students make application in extracted teeth.

No. 14. Didactic in Freshman year. In Junior year is taught on living patient.

No. 15. Yes; by didactic instruction, also actual application of drugs to teeth invested in plaster of Paris.

No. 16. Yes; both.

No. 17. Yes; chiefly by didactic instruction.

No. 18. Yes; actual application to natural teeth.

Question:—What text-book or manual of Operative Technic do you use in your course?

None, seven; Weeks, 11.

Question:—How many hours each day, and how many days each week occupied in Operative Technic work?

No. 1. 17 weeks—2 hours each day.

No. 2. 12 " —3 " " " . 6 days.

No. 3. 8 " —2 " " " 6 "

No. 4. Reports one to three hours twice each week, are assigned 3 hours each week.

No. 5. 11 weeks—3 hours—5 each week.

No. 6. 20 " —2½ " —3 " "

No. 7. 22 " —3 " —2 " "

No. 8. 12 " —3 " —6 " "

No. 9. Eight hours per week Laboratory work, throughout entire session. (Six months term).

No. 10. Our Operative Classes are in operation from 9:00 till 12:00 and 1:30 to 4:00 p. m.

No. 11. Eighteen weeks—two hours—five days.

No. 12. Blank.

No. 13. Five half days each week for first four weeks, then three half days until work is completed. (Junior year.)

No. 14. Cannot answer definitely.

No. 15. Three hours each day, except Saturday.

No. 16. Every afternoon during entire Freshman year.

No. 17. Two hours, three days each week for twelve weeks.

No. 18. Two hours each day—two days—eight months.

Question:—What are your three most prominent objects in teaching Operative Technics?

No. 1. (*a*) Dental Anatomy. (*b*) Root canal work. (*c*) Cavity preparation.

No. 2. (*a*) To familiarize students with anatomy of the teeth. (*b*) To teach preparation of cavities and manipulation of filling material. (*c*) To teach a student what instrument to use to reach a given place.

No. 4. (*a*) To teach the eye, the brain and the hand at one and the same time. (*b*) Owing to the distribution of our work some of these questions are not answered as fully as they might be.

No. 6. (*a*) Descriptive Anatomy. (*b*) Order of procedure. The necessity of sharp instruments, and cutting to symmetrical lines, and definite measurement, this gives an actual experience in

holding, cutting and controlling instruments. (*c*) Cleanliness in all work. Cavity preparation with stress on the importance of proper seat preparation. Extension of margins for preparation and proper finish of margins for prevention, and proper finish of marginal edge. Change of enamel, and finishing of filling.

No. 7. (*a*) Dental anatomy. (*b*) Manual training. (*c*) System and order.

No. 8. (*a*) Manual training. (*b*) Familiarity with teeth. (*c*) Power of individual observation and reasoning.

No. 9. (*a*) Knowledge of tooth form and structure. (*b*) Manipulative skill. (*c*) Instrumentation.

No. 13. (*a*) To train the hand. (*b*) To teach cavity form and extent. (*c*) To teach what is to be done and how to do it before practicing upon patients.

No. 14. Tooth forms. (*b*) Cavity and root preparation and filling. (*c*) Manual dentistry.

No. 15. (*a*) To develop the sense of touch. (*b*) To train the eye and hand to work in unison. (*c*) To acquaint the student with the technique of many things of which he is totally ignorant.

No. 16. (*a*) Thorough familiarity with the external and chamber form of all the teeth. (*b*) Training of the fingers to obtain manipulative skill. (*c*) The education of the judgment in the treatment of caries and other pathological conditions.

No. 17. (*a*) To teach Dental Anatomy and tooth forms and markings. (*b*) Cultivation of the *Tactus eruditus.* (*c*) Preparation of the student to operate upon the vital organs.

No. 18. (*a*) Cultivate manipulative skill. (*b*) Obtain an absolute knowledge of the parts to be worked upon. (*c*) To so place the operative procedure before the student that he may become accurate and precise in making his operations.

Question:—What is your class motto?

1. " E pleuribus unum."
2. Work.
3. Work.
4. Diligence.
5. If you were to ask the boys, I think they would say " Slide, Kelley, slide."

Respectfully submitted,
GEO. H. WILSON.

Executive Board's Report.

BY GEORGE H. WILSON.

Names of Colleges reporting in the Prosthetic Department. The numbers used to designate the Colleges do not correspond with the order of the names in this list, nor are they always the same in the text:

Royal College of Dental Surgery of Ontario.
Louisville Dental College.
Western Dental College.
Detroit Dental College.
University of Michigan, Dental Department.
Columbia University, Dental Department.
University of Buffalo, Dental Department.
Kansas City Dental College.
Baltimore College of Dental Surgery.
Ohio College of Dental Surgery.
Northwestern College of Dental Surgery.
Vanderbilt University, Dental Department.
University of Tennessee, Dental Department.
Indiana Dental College.
University of Minnessota, Dental Department.
University of Pennsylvania, Dental Department.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery..
Chicago Dental College.
Western Reserve University, Dental Department.

Question;—Have you a course in Dental Plate Technics? If so, state how many hours per week, how many weeks, and what time of the day this work is taught:

Of the twenty schools reporting, all answer in the affirmative to having a course of study in this department. It is very apparent that a few of the schools do not yet fully comprehend the meaning of a technic course of study. One school reports two hours per week, for twenty-four weeks, and in the evening.

Another school answers the questions under this head by these words: "Included in Prosthetic Technics," and, in answer to the question, "What impressions do you require in plaster?" answers, "Those that are usually taken in plaster."

Another school answers, "Yes; every day during the session, from 9:00 a. m. to 5:00 p. m.

Another school reports, "Yes; considering the question as a general one, the entire time of the first year student is devoted to this work (exclusion of lectures and other instructions outside of laboratory)."

Of the remaining sixteen schools, one reports Prosthetic Technic work four hours per week; two, nine hours; two, ten hours; one twelve hours; six, fifteen hours; one, sixteen hours; two, eighteen hours; one, twenty-five hours, making an average of a little less than fourteen hours. The schools vary much in the number of weeks during which Prosthetic Technic is taught. One school reports six weeks; three, twelve weeks; one, sixteen weeks; two, twenty weeks; one, twenty-two weeks; four, twenty-four weeks; one, thirty-two weeks; one, thirty-four weeks; one, thirty-six weeks, and one, seventy-two weeks, making an average of twenty-five weeks.

We find that the school requiring the fewest hours technic work, requires ninety hours; the one requiring the most, requires eight hundred hours; the average time is about three hundred and fifty hours.

Three of the schools report that a portion of their technic work is in the morning and part in the afternoon. The others are about equally divided between morning and afternoon.

IMPRESSIONS.

Question:—What materials used? What time devoted to each? What impressions required in plaster?

One school reports using plaster, modeling comp. wax, gutta-percha and Teagues imp. comp.

More than half the schools only report using modeling comp. and plaster; while the remainder add wax.

One school reports requiring about one week in taking impressions. Several report "till the student is proficient"; while many of the statements are obscure, it is apparent that the time usually reqnired is from two to three weeks.

It is worthy of note:—Two schools report hiring a patient with edentulous jaws, upon whom the students practice till all do satisfactory work. This, after they have spent about three weeks taking impressions of each other's mouths with wax modeling comp. and plaster.

Question:—What pieces do you require in vulcanite?

As vulcanite is used for attachment to metal bases and other purposes, this list does not represent all the experience the student

obtains in this material, although it is more than probable that some of these reports include vulcanite attachment to metal bases.

No. 1 School,	Full upper and lower,		1 partial upper,		
No. 2	2 Up	1 low	2 partial	5 repairs,	
No. 3	1 Up	1 low	1 partial		
No 4	2 Up	2 low	2 partial		
No. 5	1 Up	1 low	1 partial	1 repair,	
No. 6	1 Up	1 low	8 partial	1 repair,	2 cubes 9-16
No. 7	1 Up	1 low	2 partial	3 repairs,	
No. 8	2 Up		8 partial	1 repair,	
No. 9	1 Up	1 low	3 partial		
No. 10	8 Up	2 low	5 partial	4 repairs,	
No. 11	1 Up	1 low	5 partial		
No. 12	1 Up		3 partial	1 repairs	
No. 18	1 Up		3 partial		
No. 14	1 Up	1 low	1 partial		
No. 15	2 Up	1 low	8 partial	2 repairs	2 cubes 9-16
No. 16	1 Up	1 low	2 partial		
No. 17	1 Up	1 low	2 partial		
No. 18	1 Up	1 low	1 partial		
No. 19	1 Up		4 partial		
No. 20	1 Up		3 partial	4 repairs,	

Question:—What do you require in cast metal and what metal used?

Five schools report none; one school reports Watts optional; seven report one lower each; two schools report requiring one full lower cast to teeth, and a full lower with valcanite attachment; one of these schools also one par. lower; one school reports one lower without teeth and one lower with teeth; two schools one full lower vulcanite attachment and one partial lower; cne school reports one full lower vulc. attachment, and two partial lowers, one with teeth and the other ready for vulcanite attachment, wire stiffening in each. One school report aluminum and Watts lower.

Two schools report using tin and bismuth for casting; three schools state block tin; eight schools mention Watts metal; whether these all require Watts metal or mean Watts method is a question. One of the schools reports "lower cases" and Weston's metal, block tin, and other fusible metals.

Question:—What do you require in swaged work?

You committee deems it profitable to report the answers to this question in full.

No. 1. Requires a full upper in brass, also aluminum, partial upper and lower, the partial upper doubled over palatine portion.

No. 2. First year requires aluminum upper. Second year, one full brass or German silver for rubber attachment, one partial with teeth soldered on.

No. 3. A full upper and lower.

No. 4. None in freshman year.

No. 5. Freshman year—One full upper plate, rimmed on outside; one full lower plate, without rim. Junior—One full upper

plate, fully rimmed and loops with plain rubber teeth to articulate with lower natural teeth; one Chase combination plate with gum section teeth; one lower partial, reinforced and clasps, no teeth; one upper, partial, soldered teeth. Senior year—One partial with Condit method of retention.

No. 6. Full upper plate, soldered chamber-cap and wire rim, for rubber attachment. One partial lower, full soldered, six teeth (plain) two clasps. One partial upper cut and solder chamber, solder rim, fourteen single gum teeth, full solder.

No. 7. One partial plate, single thickness with clasps; one partial plate, double thickness, with vaccuum chamber.

No. 8. Full upper swaged base, vulcanite attachments; lower swaged stringer, vulcanite attachment; partial upper, four gum teeth, soldered clasps.

No. 9. One full upper and lower; a partial upper and partial lower.

No. 10. One full upper roof plate. One full upper and lower aluminum, turned edges. One full upper brass and soldered rim, requiring cores to cast die. One partial upper, teeth soldered on. One partial lower, no teeth.

No. 11. Two partial upper plates, one with, the other without clasps, teeth soldered to plate. One full upper with turned or soldered rim on outside; rim upon inside swaged or soldered.

No. 12. Full upper, aluminum plate, teeth attached with rubber. Full upper, brass teeth attached with rubber. Full lower, brass, soldered teeth.

Partial lower, clasps, molars and bicuspids attached with rubber. Partial upper, silver, two teeth, to give practice in soldering silver.

No. 13. One full upper and lower, brass with wire rim, teeth attached with rubber.

No. 14. One satisfactory piece.

No. 15. Freshman—One upper, on brass, wire edges, rubber attachment. One partial lower, brass with clasps, wired edges, rubber attachments. Two plain teeth soldered on German-silver plate with clasps. Junior—One upper Al, one Chase combination, one upper partial, gum teeth with clasps.

No. 16. Upper and lower dentures and partials of each.

No. 17. Partial or full piece.

No. 18. Full upper and lower; partial upper (horse-shoe); partial inferior.

No. 19. Full upper, denture of German silver, and partial upper plate of same metal in high contracted arch.

No. 20. Full upper aluminum, plain teeth with rubber attachment, Chase combination, aluminum plain teeth, pink rubber added at second vulcanization. Partial upper, brass, doubled portion, no teeth. Full upper, brass, Cleveland vaccuum chamber, no teeth. Full upper, brass, deep undercut, requiring large cores, wire rimmed inside and out, loops and pin attachment, no teeth. Partial lower, brass, bouble stringer, clasps, teeth attached with rubber. Partial upper, brass, clasps, four soldered single gum teeth with soldered rim.

Question:—Do you require technic work in continuous gum? If so, what?

Two schools report, require full up; four schools report, optional; seven report, demonstrated; seven report, none

Question:—Do you require technic work in obturator and velum, interdental splint or angle clamps? If so, state what?

Fourteen schools report, no; three schools report, demonstrated; two schools report, require obturator; one of which, with one other school, requires interdental splint.

Question:—Have you any other technic work not covered in the above? If so, what?

Three schools report technic work in celluloid.

Question:—What text-book used?

Two schools report as first choice, "American System." Five schools either name Richardson's Mechanical Dentistry or give it first place; ten name American Text-book only, or give it first choice; one school reports "There are none," undoubtedly meaning there are none especially prepared for technic teaching.

Question:—Have you a course in Metallurgy?

The answers to this question are quite amusing. One school replies, "Yes; but it is not a part of the technic work." Another replies, "Yes; after the holidays." Another, "Yes; Essig Metallurgy." One school that is known to have a technic course in this department, makes the statement so indefinite that it is impossible to tell what is demonstration in the lecture room and what is technic work pure and simple. One school replies, "Yes; first ten weeks of Senior year," but does not give an outline. Another school replies, "Yes; four hours per week after the holidays." It is probable that all schools have didactic instructions in this department,

although a few left the place for an answer blank. It is apparent that a portion of the schools have more or less demonstrations in connection with the lectures; but probably not more than two of three have a technic course.

Question:—Have you a steel technic course? If so, state number and name of instruments constructed?

Nine schools report "No." Ten schools report "Yes," and give the following as requirements:

1st. Six excavators and a spatula.

2d. One explorer, one pair right and left chisels, on triangle chisel, two band drivers for orthodontia, one band remover for orthodontia, and two double end wrenches for orthodontia, one half-dozen taps for cutting thread in nuts for orthodontia. Time, three hours per week during Junior year.

3d. Several excavators and pluggers.

4th. One set (12) soft gold pluggers, several amalgam instruments, nerve broachers and reamers. Work done at odd times, but probably takes 15. hours.

5th. Five or six steel instruments are required; generally chisels and excavators.

6th. One enamel chisel, one excavator, one plugger from bar steel, forged; five taps and filing block, for regulating work; one double end wrench. Time about sixty hours. In Junior year.

7th. One of each class of excavators and chisels, used by students in infirmary. Time, until student shows ability to construct same.

8th. Six excavators, six pluggers. In commencement, student is given a piece of steel wire, to harden one end, and overheat and harden the other end. Both ends are broken' difference in strength noted, and comparison made of difference in grain. Wire is then annealed and excavator points made experimentally. When student is proficient in shaping and tempering, he makes his six excavators. Time, about twenty (20) hours.

9th. No special number of instruments required; student is excused when considered proficient. Time, three hours per week.

10th. Twelve instruments: two chisels, two hatchet excavotors, one scoop excavator, one scaler, one ligature cutter, one spatula, one root-cannal filler, and one drill, one tap and one wrench for orthodontia. These instruments are forged in the forge room, preferably from octagon bar steel, but may use old instruments. Time, about thirty hours. Junior year, just before taking up orthodontia work.

Question:—Have you a course in crown and bridge technics?

All answer yes.

In crown work, the following will include the report both upon all metal and porcelain faced.

1st. Two shell cuspids, four bicuspids, four molars, one central and one cuspid. Richmond.

2d. One each upper and lower bicuspid and molar articulated to model. This means that the finished work must be acceptable to demonstrator, and they will necessarily have to make a great many. One each central and bicuspid porcelain-faced.

3d. Four metal and two porcelain-faced.

4th. Seven shell crowns. No porcelain-faced in freshman year.

5th. Three shell crowns—one with wide band, one with narrow band, both with caps swaged with Melotte's metal die; one with wide band cast cap, from carved model; three porcelain-faced crowns, one with band, one without band, one bicuspid made with saddle-back tooth.

6th. Five molar or bicuspid shell crowns; two Richmond incisor or cuspids and two Richmond bicuspids.

7th. Three shell crowns, one for sound tooth to be used for anchorage, two for broken or decayed teeth. In porcelain-faced, at least six, one Bonwill, one Ash, one Logan, one gold and porcelain-faced, one no band, one full band, one half band.

8th. Bicuspid and molar shell crown, until accepted as satisfactory by professor. Richmond banded crowns, and bicuspids porcelain-faced until accepted. In freshman year.

9th. Two molars and four bicuspids. Four Richmond, porcelain-faced.

10th. Six anterior open-faced. Three anterior full shell. Six full shell molars and bicuspids. Two partial shell crowns. Two Richmond crowns, with and without bands. Bicuspid porcelain-faced, Bicuspid or molar, saddle-back.

11th. Three shell crowns, showing different methods of making caps, two seamless crowns. Two Richmond-faced crowns, anterior and bicuspid. One shell with porcelain face; one Leech.

12th. Two swaged crowns. Two solder crowns. In porcelain-faced, one Darby, one modified Darby, one Case bicuspid, one Hollingsworth, one U. of M. crown, one Richmond, one Downie Poreclain.

13th. No report. This school answers "Yes," but gives no further answer under this heading.

14th.

15th. Juniors, two; seniors, three; exclusive of those in bridges. Porcelain-faced, juniors, two; seniors, four.

16th. All from cuspids back, upper and lower, porcelain-faced, incisors, cuspids, and bicuspids. Upper and lower.

17th. Bicuspids and molars. Required to construct until proficient. Porcelain-faced. any quantity. Logan, Richmond, Barmly Brown, plain pivots and other methods.

18th. One cuspid, one bicuspid, two molars. Porcelain-faced, two Richmond, central and cuspid, one shell, porcelain-faced bicuspid.

19th. Both shell and porcelain-faced crowns until the student is proficient.

20th. Ten crowns, one bicuspid shell fitted to natural root; one bicuspid, filled cuspid upon plaster mold; one molar treated the the same; one central swaged in halves; one central flap system; one bicuspid made of silver. occlusal surface cast in cuttle-fish bone; two Richmond porcelain-faced central and bicuspid; two Case central and bicuspid.

Question:—Number and describe bridges constructed.

No. 1. Four—one six-teeth, from cuspid to cuspid. One five-teeth, from cuspid to second molar, superior. One four-teeth, first bicuspid to second molar, full metal, lower. One removable.

No. 2. Two—one superior anterior of not less than four teeth. One dummy porcelain-faced and one all metal.

No. 3. Three—two porcelain and one all metal.

No. 4. None in freshman year.

No. 5. Three—one made from molar shell crown, two bicuspid dummies, porcelain-faced cuspid and extension lateral dummy. 2d. One with open-faced cuspid, saddle back dummy, first bicuspid and saddle back crown for second bicuspid. 3d. One removable bridge with telescoping crowns.

No. 6. Bridge of not less than three teeth, including shell crown, Richmond crown and dummy.

No. 7. Bridge including anchorages and not less than two dummies.

No. 8. Three bridges as specified by professor, for cases selected by him.

No. 9. Three bridges. 1st, two shell crowns and three dummies; 2d, one Richmond crown, one shell molar and three dummies; 3d, same as second, made removable.

No. 10. Eight bridges. 1st, lateral facing attached to open-faced cuspid; 2d, six anterior teeth, Richmond crown attachments;

3d, pin plate bridge, lateral attached to central and cuspid; 4th, upper central and lateral tipped dummies, attached by two shell crowns; 5th, lower four teeth, molars and bicuspids, all metal; 6th, four teeth, open-faced cuspids and shell molar bicuspid dummies, solid grinding surfaces; 7th, four teeth, banded Logan on cuspid as anchorage saddle-back dummies; 8th, removable bridge, all metal, telescoping crowns attachments.

No. 11. Four bridges. 1st, shell crown, dummy attached; 2d, Richmond-faced crown, with dummy; 3d, one shell crown and one open-faced crown for support; 4th, Richmond-faced for both supports. If time permits, one with four attachments, two Richmond and two shell crowns.

No. 12. Four bridges. One crib with two teeth. One with dummy and two shell crowns; one with crib, one Richmond and two dummies for lower incisors; one removable or saddle bridge with two teeth.

No. 13.

No. 14.

No. 15. Seniors two. One or more suspended teeth may be a wing bridge, one abutment; 2d, two or more suspended teeth, cap at both ends of bridge.

No. 16. Number indefinite.

No. 17. Innumerable. Bridges of every character and description. A specialist clinicing every day at certain hours in this branch.

No. 18. Three bridges. 1st, central and cuspid, Richmond crowns, lateral dummy; 2d, first superior bicuspid and second molar shell crowns; 3d, inferior cuspid and first molar shell crown.

No. 19. A fair degree of proficiency, not numbers, required. The cases taken up range from thirteen teeth, having five points of anchorage, down to the simplest forms.

No. 20. Four bridges: 1st, open-faced crown upon second bicuspid, a cuspid dummy for first bicuspid and a lug resting upon cuspid; 2d, inferior half cap upon cuspid, shell crown first molar, metal dummies: 3d, half cap upon cuspid, four incisor dummies, Richmond crown cuspid, porcelain-faced dummy, bicuspids, and shell-crown upon molar; 4th, removable bridge, half cap cuspid with a modified Condit attachment, telescoping shell crown upon first molar, bicuspids supported upon vulcanite saddle.

Question:—Do you require any work in platinum and enamel crown and bridge work?

Twelve schools answer "No," or leave the space blank. One reports, "Optional." One answers "Yes," but does not state what. Another answers, "None in Freshman year." Four schools answer yes, with the following statements of requirements:

1st. Two crowns and one dummy assembled in bridge.

2d. One latteral incisor, after Downie process.

3d. Two crowns and a four-tooth bridge.

4th. Any of the anterior teeth.

Question:—Have you a course in orthodontia technic?

Two schools answer "No." While some of the remaining schools answer "yes," it is very apparent that they have no distinctive technic course, but confine instructions to practical work.

No. 1. Two for spreading arch; two for forcing out single tooth; two for drawing in single tooth; two for forcing out two or more teeth; two for drawing in two or more teeth, and two retaining appliances.

No. 2. This school answers "Yes," and then makes the following statement: Some questions asked I cannot answer, not knowing what you want. We do most of our technics in the mouth; prefer it to laboratory when we can do so, our clinic being sufficient for us to do so.

No. 3. Reports—The steel technic is part of the preliminary work; in addition we require students to roll out wire for band material, draw tubing and wire to fit and make nuts for different sized screws. German silver used for this work. Pieces assembled, as follows: Three screw bands, two kinds of jack screws, two kinds of traction screws, one ribbon and screw appliance for interlocking teeth, one angle retraction appliance, one lever for rotation, one Jackson crib for retention.

No. 4. Reports—Plate of vulcanite with screws and spring attached; two angle clamps, jack-screw push, jack-screw draw, expansion arch (angle system).

No. 5. Four appliances—1st, for expansion of arch; 2d, moving individual anterior teeth; 3d, for rotation; 4th, for retention. These are varied each year.

No. 6. We are introducing it this year, so cannot give particulars.

No. 7. Angle appliances; Coffin plates, upper and lower; wire articulator, with casts. Kingsley plate, Goddard plate.

No. 8. Reports under head of preliminary work, "Furnish them to students, as they will find them in the market. It is a waste

of time to teach students to make nuts, taps, drills, tubing, etc." Assembled appliances, Angle double rotation appliance, Angle jackscrew appliance, single and double; Angles retraction of cuspid appliance, Angle expansion appliance.

No. 9. All work in this done on practical cases.

No. 10. Upper and lower Coffin split plate; one lower Jackson crib and piano wire appliance; three Case and Angle appliances.

No. 11. Answers "Yes."

No. 12. Coffin plate spring applied to tooth; Jackson crib. Instructions given in making taps and cutting nuts and screws.

No. 13. Taught by chair of operative dentistry and by resident demonstrator, by didactic lectures and clinical work.

No. 14. No special number; taught from practical cases as presented in infirmary, also demonstrated on models.

Pieces assembled depends entirely on case under consideration.

No. 15. Each student is required to make and adjust appliance to casts both for correction of irregularities and retention.

No 16. Three pieces, first—to rotate a tooth; second—to draw a tooth into position when outside of arch; third—to correct the position of teeth when inside of arch.

No. 17. As steel technic just precedes this course, the drill, tap and wrench partially belong to this course of preliminary work, followed by rolling bands, drawing wire and tubing to size, and making nuts and screws. Pieces assembled three. First—a composite piece demonstrating spring bar, jack and traction screws and bands; second—Jackson crib, both outward and inward movement of tooth; third—Coffin split plate.

Question:—State hours required for orthodontia and when introduced. Only nine schools reported upon this question.

1. Thirty hours, junior year.
2. Senior year.
3. Twenty hours.
4. One hundred hours, junior year.
5. Seventy-two hours, junior year.
6. Two hours per week, till finished.
7. Indefinite time. Last half of Junior year.
8. Every forenoon (3 hours) during Junior year. This would make for this school about 470 hours.
9. Fifty hours.

Your secretary, upon this report, would suggest that a committee be appointed to formulate a syllabus of a minimum desirable

course in Prosthetic, Crown and Bridge, Metallurgy and Orthodontia technic, including suggestions how this course can be utilized with profit, and a copy be sent to each school belonging to the National Association of Dental Faculties, with a request that, if they have not a more desirable one, they adopt this with as many additions as they may wish to make. Also an invitation, if they are not already a member of this association, to cast their lot with us.

It is also suggested that if a similar report to this is to be made in the future, the list of questions shoud be materially changed, so that the answers will be more uniform. It is apparent that much practical work is reported upon as technic work, also that some schools will have a very indefinite idea of real technic work, as implied by the National School of Dental Technics.

Respectfully submitted,
GEORGE H. WILSON,
Secretary of Board.

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1898

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George Edwin Hunt, M. D., D. D. S.

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PROCEEDINGS

OF THE

SIXTH ANNUAL MEETING

OF THE

National School of Dental Technics

FOR THE YEAR 1898, CINCINNATI.

THIRD VOLUME, PUBLISHED 1899.

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Communications hitherto unpublished

INTRODUCTORY.

In presenting this, the third published report of the National School of Dental Technics, your committee wishes to offer a suggestion with the hope that it will be acted upon by those taking part in the discussions.

With each succeeding year the papers and discussions become more voluminous. If too voluminous, the book which is intended as a sort of annual guide to dental teachers will in a measure fail of its purpose, because it will be less carefully read. It is therefore desirable that the discussions be prepared beforehand, and the Executive Board gives notice that next year all discussions reported by the stenographer will be edited or abstracted so as to present only the facts bearing directly upon the subject. Let us remember that it is the *subject* which is discussed and *not* the *paper;* thus all have an equal chance to prepare their discussions in advance. The rather bulky discussions of this session are printed as reported, with only the necessary orthographical corrections, as the committee hesitated to abstract them without previous notice.

(Signed) D. M. CATTELL,
T. E. WEEKS,
H. J. GOSLEE,
Editors for Executive Board.

MINUTES.

Cincinnati, Ohio, Grand Hotel,
December 28, 1898, 10 a. m.

Meeting called to order by President G. V. Black. Twenty-four colleges were represented (about 75 individuals.) See note.

Report of Executive Board received and ordered placed upon the records. The report is as follows:

At the opening of the meeting in Chicago, December 29, 1897 (the Fifth Annual Meeting), the school had a membership of 32. Twenty-one colleges were represented by one or more delegates. During said meeting, three colleges made application and were elected to membership, namely, Missouri Dental College; Milwaukee Medical College, Dental Department, and Ohio Medical University, Dental Department, making a total membership of 35. There has been a withdrawal from membership of five colleges, three of which have gone out of existence, one for non-payment of dues, and one by request, leaving a total membership at the present time of 30 colleges. On the same date the Treasurer had on hand $180.54, and received during the 1897 meeting $175.00, making a total of $355.54.

During the session there were audited bills and other vouchers for typing and printing proceedings of the first, second, third and fourth meetings, and reporting and typing of the fifth, or 1897 meeting; also stamps, postal cards, wrappers, stationery, expressing, and other incidental expenses to the sum of $265.70, leaving a balance in the treasury at the close of the '97 meeting of $89.84.

During the time from closing of last meeting till the convening of this present one, there has been received from membership colleges, not present at the last meeting, $35,

making a total of $124.84. With disbursements during the year for stamps, stationery, printing programs, and printing of '97 proceedings, to the amount of $108.50, leaving a present total of $16.34, with an unpaid balance on the printing bill (proceedings of '97) of $45.

In view of the fact that when all yearly dues are paid in full, the sum of which amounts to $150, and the printing of our annual proceedings and programs, with the cost of reporting and other expenses, exceeds the sum of the annual dues, we recommend that the annual dues be increased to $10, and that Article 4, Section 2, of the Constitution be so amended immediately as to read: "The annual dues shall be $10 from each college, payable in advance."

We further recommend for immediate passage, that Article 3 of the Constitution, Section 1, be so amended as to read:

"The regular meetings shall be held during the Christmas vacation of each year at such date and place as shall be selected by the Executive Board."

We also present to you for consideration the program for the present session, printed copies of which are before you.

Respectfully submitted,

D. M. CATTELL,
Chairman,
G. H. WILSON,
G. E. HUNT,
Executive Board.

The recommendation of the Board to increase the fees from $5 to $10 annually, after this year, was moved as an amendment to the Constitution to take immediate effect. Also the recommendation regarding the amendment of Constitution, so that the regular meetings shall be held during the Christmas vacation of each year at such date

and place as shall be selected by the Executive Board, was acted upon by motion. There being no objection, the suspension of the rules was allowed and the recommendations took immediate effect. The amendments were ordered written in the book of Constitution and By-Laws.

The President then gave his address, as called for on the program, and discussion followed.

Adjourned.

Convention met at 2 p. m. President Black in the chair.

Three applications were recommended by the Executive Board for membership, namely, Pittsburg Dental College; Dpartment of Western University of Pennsylvania; New York College of Dentistry; Dental Department of University of Omaha. The same were duly elected.

The next program number, by Dr. Brown, was read, and discussion followed.

Adjourned.

Convention met at 8 p. m. President Black in the chair.

Prosthetic Technic Syllabus Committee made report by its chairman, Dr. Hoff.

Operative Technic Syllabus Committee made report by its chairman, Dr. Weeks. Each gave partial syllabi.

By motion, the committees were continued, with instructions to report more fully next year. Discussion.

Adjourned.

December 29, 1898.

Convention met at 10 a. m. President Black in the chair.

Minutes of previous day's proceedings were read and approved.

Drs. Whitslar's, Wright's and Burchard's papers were then read and discussed. Dr. Burchard not being present, his paper was read by Dr. Guilford.

At 12:30 o'clock an invitation was accepted to a luncheon given by and at the Ohio College of Dental Surgery, the same being served in the "Taylor Hall." The affair proved a success.

Convention met at 2 p. m. President Black in the chair.

Dr. Wilson read a paper, as provided for in program. Discussion followed.

Drs. Johnson and Broomell not being present, their papers were read by the Secretary, and discussion followed.

Convention met at 5 p. m. All papers having been read and discussions finished, it was thought best to elect officers for the ensuing year before adjournment, in order to finish all work of the meeting, to obviate the necessity of an evening session.

By motion, it was made the next rule, and resulted in the following elections. The rules having been suspended, election proceeded by nomination and acclamation: President, N. S. Hoff, Ann Arbor, Mich.; Vice-President, H. P. Carlton, San Francisco, Cal.; Secretary-Treasurer, H. J. Goslee, Chicago, Ill. Executive Board: D. M. Cattell, Chicago, to succeed himself; vice G. E. Hunt, resigned, H. W. Morgan, Nashville, Tenn. (The Board as now constituted stands thus: G. H. Wilson, 1 year; H. W. Morgan, 2 years; D. M. Cattell, 3 years.)

Three gentlemen were then appointed to conduct the newly elected officers to the platform, where they were greeted cordially by the retiring officers. Appropriate remarks were made, after which a motion prevailed that thanks be tendered to the retiring officers for efficient service, especially Dr. Molyneaux, Master of Exhibits. Thanks were also tendered the local Committee of Arrangements, the Ohio College of Dental Surgery for its complimentary luncheon, and the hotel management for its accommodation.

The minutes of the day's proceedings were then read and approved—6 p. m.

The meeting of 1898 then adjourned.

D. M. CATTELL,
Secretary and Treasurer.

PROGRAM.

WEDNESDAY, DECEMBER 28.

10 a. m.—Organization (Payment of Dues); Executive Business; President's Address (G. V. Black). Discussion by S. H. Guilford, T. W. Brophy and H. A. Smith.

2 p. m.—The Value of a Graded Course of Study and Uniformity Among Dental Schools (G. V. I. Brown). Discussion by M. T. McLean, E. C. Kirk and J. Taft.

8 p. m.—Report of Committee on Syllabus for Prosthetic Technics (N. S. Hoff, chairman). Discussion by Grant Molyneaux, T. H. Lewis, J. G. Harper and H. B. Tileston. Report of Committee on Syllabus for Operative Technics (T. E. Weeks, chairman). Discussion by J. A. Dale, J. F. Stephan, W. G Foster and L. S. Tenney.

THURSDAY, DECEMBER 29.

10 a. m.—Symposium of Teaching Methods: Conduct of the Operative Clinic (by W. H. Whitslar); The Problem of Methods (by C. M. Wright); Lecture and Class Methods (by H. H. Burchard). Discussion by the House.

2 p. m.—Steel Technics (G. H. Wilson). Discussion by G. B. Snow, J. D. Patterson and G. V. Black. Teaching Cavity Preparation (C. N. Johnson). Discussion by W. E. Harper, H. W. Morgan and W. J. Brady.

8. p. m.—Volunteer Paper: Technic Methods in Tooth Occlusion (by I. N. Broomell). Election and Installment of Officers. Adjournment.

NOTE.

LIST OF MEMBERSHIP COLLEGES PRESENT, WITH DUES PAID AND ENTITLED TO A VOTE.

Royal College of Dental Surgery.
University of California, Dental Department.
University of Michigan, Dental Department.
University of Buffalo, Dental Department.
University of Minnesota, Dental Department.
University of Western Reserve, Dental Department.
Northwestern University, Dental Department.
Vanderbilt University, Dental Department.
University of Pennsylvania, Dental Department.
Southern Medical College, Dental Department.
Milwaukee Medical College, Dental Department.
Marion Sims Medical College, Dental Department.
Ohio Medical University, Dental Department.
Cincinnati College of Dental Surgery.
Chicago College of Dental Surgery.
Ohio College of Dental Surgery.
Louisville College of Dental Surgery.
Pennsylvania College of Dental Surgery.
Birmingham Dental College.
Philadelphia Dental College.
Missouri Dental College.
Indiana Dental College.
Kansas City Dental College.
Atlanta Dental College. Total, 24.

ELECTED TO MEMBERSHIP AT THIS MEETING.

Pittsburg Dental College.
New York College of Dentistry.
University of Omaha, Dental Department.

MEMBERSHIP COLLEGES THAT WERE WITHOUT ACCREDITED DELEGATES.

Baltimore College of Dental Surgery.
Detroit College of Medicine, Dental Department.
University of Iowa, Dental Department.
University of Tennessee, Dental Department.
Western Dental College.

PRESIDENT'S ADDRESS.

G. V. BLACK, M. D., D. D. S., SC. D., CHICAGO.

Gentlemen of the National School of Dental Technics—According to usage in such associations, it becomes my duty to address you upon some subject pertaining to the work of this body. This Association of teachers was called into existence in 1893 by the need felt for comparative study of methods of teaching the more purely technical subjects in dentistry in our dental schools, and for the diffusion of a knowledge of technic methods among teachers. At that time classes in operative and prosthetic technics had been formed in but few of the dental schools, and it was the belief of those teachers who had engaged in this work, or had witnessed the results of the methods employed, that all dental schools should organize such classes. It was also felt that the methods employed might be greatly improved, and that by associated effort and the comparison of plans that could be had in this body this improvement would be greatly facilitated.

For the best results in the practice of our specialty, much careful training of the hand and the eye is required, combined with the more purely mental studies of principles, or the fundamental subjects of anatomy, histology, physiol-

ogy, materia medica, therapeutics and pathology. In practice we are constantly called upon to do delicate operations requiring the most precise manipulative procedures.

This calls for an intimate knowledge of the structures operated upon and such wealth of finger skill as will do perfectly that which the mind conceives. The technic courses were planned with the special object of assisting the development of this skill.

This includes in the operative branch, especially, a study of the anatomy of the teeth and their physical properties as resistant bodies, and their behavior toward cutting instruments, the physical properties of steel and the nature and forms of instruments for operative procedures, the physical and working properties of the metals and other materials employed in operative dentistry, and a practical study of the manipulative procedures or handicraft processes to be employed in practice with the view of the development of manual skill and dexterity.

In the prosthetic branch this includes a broader study of the metals and other materials employed, together with their resistant, tensil and other physical characters, and the manipulative procedures or handicraft processes in fashioning them into the artificial appliances required in dentistry, with such study of methods and applications as can be had without the actual application to the mouth of patients requiring them.

These studies, when divided with the study of general anatomy, histology, materia medica, etc., in the earlier part of the student's dental school work has proved of great value, and it has been the object of this association of technic teachers to broaden and make better the modes of presenting them to students. Heretofore these lines of work and study have been closely adhered to in the meetings of this body, but latterly there is seen a strong tendency to include other subjects of dental teaching. The question

now comes as to whether it is wise at this time to extend our efforts so as to include teaching methods in general, as these pertain to dental schools. Technic methods and the organization of technic classes has not yet become universal to the dental schools of this country. A working knowledge of these plans has been as yet but partially diffused, only a part of the schools having adopted them in their full scope. Neither have these plans as yet been so completely developed and crystallized into form that any considerable number have agreed definitely as to the order and method calculated to produce the best results. The plans have been on trial but eleven years, which is too short a time for their full development. In this time I believe no school has begun this work and dropped it, while a considerable number that have begun in a feeble way have added vigor to their courses later, thus adding testimony to the usefulness of even a very imperfect trial of this method of teaching.

Now, as I look over the program prepared for this year, I notice a tendency to introduce subjects for study and discussion that do not belong strictly to technic methods. Also I notice in the minds of those with whom I discuss these subjects a seeming desire to extend the scope of the discussions of this body to the general subject of teaching methods in dental schools. It becomes a question in my mind as to whether the time is ripe for this. Upon its organization it was supposed that the National Association of Dental Faculties would undertake the discussion of general teaching methods, but in this much disappointment has been felt by many teachers. The Faculties Association in its meetings has constantly had under discussion questions of management of dental schools rather than teaching methods. Such questions as grow out of the relation of dental schools to each other. The relation of the dental schools to the laws of States and their examining boards, rules for admission of students, rules for the transfer of

students from school to school, extensions of the school term, and other corelated subjects have occupied its entire attention. These, or similar questions, are of great importance in their bearing upon dental education, and the prospect seems to be that they will continue to occupy the attention of the Faculties Association for many years to come.

Under these circumstances, men who are anxious to study methods of teaching more fully and to hear discussions of these by others are looking to this association for that opportunity. This desire to discuss methods of teaching is a laudable one. It should be fostered by every dentist interested in developing the best plans of instructing the young men entering upon the practice of dentistry. It is not a question with me as to the desirability of this broader work, but rather the question of whether or not this school of technics has so far accomplished the work for which it was organized as to be ready now, or in the very near future, to make this change and become a national school of dental technics and pedagogics, including the discussion of the full range of subjects taught in dental schools; or should it for yet some time to come confine itself to the object of its organization, the development, promotion and diffusion of the purely technic courses of study. Which will most surely contribute to the welfare of dentistry?

I would earnestly advise that, whatever name and form this association may take in the future, it should not extend its subjects of discussion beyond methods of teaching. It might well discuss the order of curriculum in its relation to the presentation of subjects to pupils, but discussions of the order of the curriculum as affecting the relation of school to school is certain to drag in questions of school management that will defeat a discussion of modes of the presentation of subjects to pupils. It might often be nec-

essary that some discussion of the order of the curriculum would involve a discussion of length of term, and very properly, and yet a discussion of length of term as a question of the relation of school to school drags in questions of school management that would easily defeat the discussion of the principles of dental technics and dental pedagogics.

These distinctions may appear to some of you to be finely drawn, but from my observation of men, their ambitions, interests and tendencies of thought, I can assure you that if the membership of this association desires that it shall undertake the study of general dental pedagogics and continue in that work, it must rigidly refer all questions of dental school management to the Faculties Association.

Again, this association should not become a dental society simply, by admiting for discussion new discoveries, or papers of general professional interest not relating directly to teaching. Many such might be presented that would be of great interest and of unquestioned importance to the advancement of dental science, and yet not bear directly upon teaching methods. Such papers and discussions belong to the National Dental Association, or to some of the numerous State or local dental associations. To admit them here would soon convert this from a national school of dental technics and dental pedagogics into an ordinary dental association. This seems to me too clear to require further discussion. The necessity for judicious care and judgment in this matter cannot well be misunderstood.

The membership in this association, if changed into a national school of dental technics and dental pedagogics, should be confined to those actually engaged in dental teaching in our schools, and those whom we may choose to honor with membership because of their long and meritorious service in dental teaching. It should not be suffered to

become an association of the general members of the dental profession because of the tendency this would introduce to the discussion of topics of general professional interest.

It is also my opinion, and an opinion which I have heard expressed by many, that the meetings of this body should be during the holidays, or in mid-term of the majority of the dental schools. This is a time when teachers are in the midst of their year's work in teaching, and are engaged in active thought as to their methods of presenting dental subjects to pupils. For this reason they will be in the best mental condition for the discussion of such subjects.

I have said this much in the belief that the time will come, if not already here, when the scope of this school of dental technics should be so enlarged as to admit the discussion of the general subjects of dental pedagogics. The best time may not be this year, nor next year, but it seems to me that it is time that such changes as will best subserve the interests of dental education should begin to be discussed in order that our thoughts may form and crystallize into symmetrical relations with the subject matter of future teaching methods.

Dr. S. H. Guilford, Philadelphia: It is hardly necessary for me to say that I was very much gratified with the thoughts presented by Dr. Black and with the manner in which he presented them. I heartily agree with all that he has said. It is not a very easy paper to discuss because there is nothing to antagonize. But possibly something might be said to emphasize the points that he brought out. There were two or three points of importance in the paper. One was in regard to the future of this association. Those of us who are intimately acquainted with the history of this body know that it was organized some years ago for the express purpose of giving the subject of technic teaching the attention that it should receive. If this work could

have been done by the Faculties Association they would undoubtedly have done it, but they had too much other work to do, and so this organization was born. Now, when an organization is born, as when a child is born, it is a little hard to tell just what the scope of its life work will be. Indeed, we have had a very good instance of that during the past year. When a nation or a people start out upon a certain path or mark out a course of action they never can tell exactly where they are going to wind up. Very frequently what they started out to accomplish broadens to such an extent that when their work is finished it includes a great deal more than was first intended. This association started out exclusively for the purpose of taking up the matter of technics and technical teaching. Dr. Black says it is a question in his mind whether this organization has fully completed its work in that regard. I do not think it has, and I do not think it ever will, and for that reason I should hesitate to continue this organization exactly upon that line. We have been in existence a number of years and the interest in this work has been continually growing. But I do think that we have been in existence long enough for all the schools that really intend to become interested in this work to have done so. I doubt very much whether there are many schools outside of this organization that will take up the matter of dental technics in a serious way, I believe that those who are in it will continue and that some others will come in, but I do not believe that it will become general among those who have not yet connected themselves with it; consequently, I believe that the technic work has broadened about as far as it is going to broaden. But I believe this body has a larger work to do and I believe that that work has been placed upon its shoulders by the force of circumstances, not by its own choice. There is probably nothing more interesting to a teacher than the acquisition of new ideas in regard to teach-

ing. Teachers like to get together from time to time and exchange ideas, and everyone who attends a meeting of that kind usually feels that he has been the gainer. Now, with that in view it seems to me the most important matter connected with dental teaching is to perfect the methods. That work would naturally belong to the Faculties Association; I am quite confident that that was part of the idea in its organization, but its time has been so much taken up with other matters of detail, matters of dispute between colleges, etc., that it has really had no time to give this matter of dental teaching any serious consideration. Now, as that organization has not had the time to take it up, and as it is an important matter, it seems to me that circumstances have laid the duty upon this organization. I therefore feel that the time has come when the scope of this organization should be broadened and that we should change the name of the organization and call it, possibly, not only the National School of Dental Technics, but the National School of Dental Technics and Pedagogics. That would give it a broader scope and one, I think, that would be beneficial in every way. It comes easily within the province of this organization, I think, to take up the matter of pedagogics. Somebody must do it; the Faculties Association can't do it; no one is more interested in dental teaching than are the members of this organization; it might as well be done by one body as by the other. The one organization evidently cannot do it because it has not the time; this organization can. Perhaps two years ago in considering the matter of the proper work of this organization it was suggested by one or two of the most active members, those most active in the organization of this body, that the matter of teaching methods should be taken up. It was suggested one year that one or two should come before this organization at its meeting and speak upon that subject and see whether the members were really inter-

ested or not. The experiment was made and it was found to be very successful; everybody seemed to be pleased with the idea of broadening the scope of the organization, and for that reason we have to-day upon our program a number of papers relating purely to methods of teaching. It seems to me that the fact that the work is approved of by the members is evidence that we need the work and that they feel the need of it.

I heartily approve of the idea of linking matters of teaching methods with the work as it has been done here. I think it will not only be more interesting and instructive, but I believe it will bring in those representative schools that have not yet manifested any interest in it. I believe it will increase our membership and increase our attendance at meetings considerably. I agree with Dr. Black that we should take up the matter of pedagogics, and that we change that part of our constitution which relates to the title of the organization and give it one which will take in the entire field.

Dr. Truman W. Brophy of Chicago: I was highly pleased with the paper that was read by our president, and also with the enthusiastic remarks made by my friend, Dr. Guilford, except a certain remark that he made which I hardly agree with. The president in the presenting of his paper, as I understand it, did not advocate the adding to the work of this body the question of teaching methods or pedagogics, but he proposed to put it before us for our consideration; it was a query. It is true the National Association of Dental Faculties has been overwhelmed with the work of effecting the perfect organization of schools. Had that body not existed, I doubt that this one ever would. It is not necessary for me to remind you that when the National Association of Dental Faculties was organized it was possible for a practitioner of five years' experience to enter a dental college and become a candidate for grad-

uation at the close of one term. And you all know how the association developed the educational methods, broadened them and lengthened the term from time to time, until now we have three years. Formerly it was one year of four months; then it was five months; then two years of five months; then two years of six months. Now we have three years, and at the last session these three years were extended to seven months each, and the tendency is to extend the course to four years of eight months each. So the National Association paved the way for this body; it enabled the colleges to broaden out and add to the course of instruction. I doubt very much the propriety of this body taking up the subject of methods of teaching work generally. See what it will involve, to take up the course of study in our schools and go through it in all the departments. All the different departments would have to come here and present their methods. Would it be possible? I don't know. I am not prepared to say. It seems to me that we have quite enough to do in taking up the work for which we were organized and making it broader and better than it ever has been. If we do that we will find that we will be kept quite busy. I don't see how it would be possible to take up all of the work that is done in the schools and treat it in the way that we do these subjects of operative and prosthetic technics and orthodontia. Those are the chief topics of discussion in this body and always have been. I am not opposed to expanding if a plan can be formulated that will be practicable, but that is where the difficulty will be. I don't see how it can be done unless we have a longer session than we are ever likely to have. Maybe we will need another association to take up the scientific branches. The subject of bacteriology has grown to such an extent that there should be a meeting of teachers in that department of our college work to discuss the best method of presenting that subject. We all know that the way it is pre-

sented in the medical course to the medical student is not the way to present it to the dental student. We need to have the work especially adapted to the student of dentistry. I think this is a subject that should be very carefully considered before the association commits itself to a change. The general tendency in America in these days is toward expansion and perhaps it has taken hold of the members of this body. But we need to be cautious, to know what we are going to do when we do expand. We may find a way, but let us be cautious.

Dr. H. A. Smith of Cincinnati: It occurs to me that if you note the object of this organization and then notice what is included in the program for this meeting, you will see that it is a very great departure from that object. What is the reason that we have been diverted from the original purpose; is there any reason for it? Is it because there is not enough in the scope of a study of dental technics to hold together an organization like this? If that is true, those who manage for us naturally would inject anything which would be of general interest to us. When we have done this we have usurped the object of two other organizations. What is the object of the National Dental Association? It is to cultivate the science of the art of dentistry and its collateral branches. That includes everything, does it not? Some criticism has been made upon the work of these organizations, societies which Prof. Black mentioned. The American Dental Association did not accomplish the work which its founders expected it to, so it went out of existence. Now we have a new organization. Why not be patient with that and let it work out its own salvation? That organization has a great destiny and I think we will all some day be proud of its achievements. Now come to the Faculties Association. What are its objects? The object of the Faculties Association is to promote the interests of dental education. Again, this in-

cludes everything. I believe that it is possible for the Faculties Association to embrace in its consideration the study of technics. They have not indulged very much in the discussion of methods. Why is that? It is because they are a new organization and they have been concerned in administrative work. But that is nearly done; nearly all the colleges are in that ought to be in (I ought not to say this, perhaps), so in the future it will not be struggling against or for the admission of colleges. And you will find in a few years that they will get down to the very basal principles of that organization, the discussion of methods of teaching. Now that is a hopeful view of it; therefore, when we expand the scope of this organization are we not likely to usurp the object of the Faculties Association?

The Faculties Association will take up the methods of teaching; they are prepared for it; it is a better organization for that purpose than this. Now, then, have we gotten away from the object of this organization because it has too narrow a scope? I would not decide that question. I have no criticism to make upon the program of to-day. Expansion is the order of the day. Let us have Cuba, let us have the Philippines, but I think when it comes to the line of expansion in this organization we ought to be careful.

The address was admirable and I feel some diffidence in following or attempting to follow such a paper. I have no discussion. I only say we ought to go a little careful and not attempt to usurp the object of our other organizations.

Dr. G. V. I. Brown of Milwaukee: I find myself in a somewhat peculiar position. A subject was assigned to me, as I understand it, with the consent and, as I was lead to believe, partly by the advice of the president of this organization. It was assigned to me, not because of any special benefit that it might be, but simply to make a young

man put in a lot of hard work. Now I can testify that so far as the hard work is concerned they made a good choice, but in view of the president having changed his mind in regard to what subjects should be brought up here, I find myself in a somewhat peculiar position. However, I think that those who listen this afternoon will be satisfied that I have eliminated the objectionable features, so far as possible. The subject could not be properly discussed without having before us the different courses of the different colleges, but so far as comparison is concerned I am sure you will do me the justice to say that that has been eliminated. However, I would recommend that the president and the committee get together on these things in the future.

Dr. Geo. E. Hunt of Indianapolis: I hardly think that Dr. Smith's arguments are perfectly sound, especially in regard to the National Dental Association and to the Faculties Association. The fact that the National Association and the Faculties Association assert in their constitution and by-laws that they will cover everything under the sun pertaining to dentistry is no guarantee that they will do so. They have not in the past, and we have no reason to believe that they will in the future. The Faculties Association has been very busy with other matters, and I have not been able as yet to see any opportunity for them to get away from this business that they have had in hand for years. There are some questions involved in broadening the scope of this body. I believe that I would more favor winking at the fact that we are expanding our scope a little than I would favor taking a deliberate step in that direction. I believe expansion should be tried on the side, as it were, for a while. I see this one difficulty—if we enlarge the scope of this organization as much as has been advocated by Dr. Guilford, unless we have a very long session and a great number of papers we will have a program that is only partially of interest. For instance, if we have a paper here,

no matter how well written or how well delivered, on bacteriology, anatomy or chemistry, not many of the technic teachers will care very much for that particular session. Now, we can't cover every branch in the college curriculum at one meeting of this association and the difficulty would be to make the program general enough to interest all. I think it is a question that is fraught with great possibilities one way or the other, and it ought to be gone into very carefully before we obliterate the object for which the organization was formed and which has nourished it all of these years. I am a little in favor of sticking to the title and making the technic work our chief work, even if we do each year have one paper, perhaps, on subjects that are of greater general interest.

Dr. G. H. Wilson of Cleveland: There was a remark made a short time ago that there were other societies that were greater than this and that we were usurping the power of those societies. I desire to make the statement that no individual, no society is greater only so far as it does the work that is assigned it to do. And that being the case,—

Dr. H. A. Smith: I believe the gentleman is quoting me, but he is a little deaf.

Dr. Wilson: What I was about to say is that this society has a great chance of doing work. And so far as the expansion is concerned, I do believe that it should be confined to the practical side of dentistry, I do not see how technical teachers would be interested in those branches which do not have the technic side.

Dr. E. C. Kirk of Philadelphia: I came in just as Dr. Black was pronouncing the benediction and did not even get the gist of his paper. All that I got has been from the subsequent discussion. I have been very much interested in the topic which has been discussed here, and if I may be forgiven for going a little wide of the mark at times I will

endeavor to say something about that particular point. It seems the plea has been made that because the National Dental Association, or first the American Dental Association, and afterward the National Association of Dental Faculties, have announced as their purpose the study and promotion of questions relating to dental education, that, therefore this society should not usurp their field. I do not agree with that idea at all. I do not believe that any organization has the right or should be accorded the privilege of pre-empting a field of that sort. And I agree with the speaker who said that the association who does that work the best is not only the strongest association, but the one which has demonstrated its right to live. I agree with Dr. Guilford that the work of the National Association of Dental Faculties is very largely administrative and governmental, and at times very exciting, so much so that the more deliberate discussion necessary for the clear understanding of educational problems is likely to interfere, I think, with the success of the study of educational matters in the National Association of Dental Faculties. I do not know that this society has ever had defined exactly what dental technic is. It seems to me that what we propose to do is to define that term somewhat and broaden its scope. I think that the question of dental technics as it was first defined was perhaps rather too narrow for the work of this association. I think the tendency would be to exalt the importance of much of what has been called dental technics. I simply wanted to emphasize that I am in favor in general of the idea of expanding the work of this body to include, not simply manual training methods, but also the psychological principles of dental pedagogics. The objection has been made that the program would be too diversified. I do not see that that is as formidable as it appears at first glance. We cannot expect to settle the whole question of educational curriculum at one meeting, and if we

have done good work in one particular branch, whether it be bacteriology or anatomy, then we have done sufficient for that particular session. If this association cannot do this how can any other association? It is doing good work, why can't it do better work?

Dr. T. E. Weeks of Minneapolis: I find so much to agree with in the remarks of all the speakers that I feel very much at a loss to say in a moment what I would like to say. But the fact has been stated that there was a feeling of a necessity for such an organization as this. That the promoters of the organization made no mistake, I think we had last year and have to-day abundant proof. None of the men who had the interest of this school of dental technics at heart had any desire to antagonize any organization or to encroach upon their field in any way. There was simply a feeling that there were certain things relating to dental education that were not being discussed at such time and place as to give men an opportunity to give their best thought and attention to it. And the growth of this school of dental technics has been a gradual evolution. It was referred to as a child. It is growing naturally. Now let us not try to fill that child full all at once. Let us not expand, as Dr. Smith says, too rapidly. But I think Dr. Kirk hit the nail very aptly when he said that we should redefine the term, and in redefining that term we will find the scope of this school of dental technics. Dr. Brophy said to me coming down that he was in accord with Dr. Kirk, not to redefine the present term, however, but to substitute a term which would cover all that those interested in this institution and in dental education desired it to do. He suggested the term, dental technology, instead of dental technics, which in a measure would comprise the technics, pedagogics and the subjects of strictly dental teaching. It seems to me that we should endeavor, at present at least, to confine ourselves to those practical, strictly dental sub-

jects, which include the manipulative. And I can't see why such a paper as Dr. Brown will present should be out of place here, because, while it may of necessity refer to other subjects than those which more strictly belong to us, still, there is very much in his report that does belong to this association. Let us hear that and pass the rest by. Now I think that there is really a great unanimity of sentiment in regard to what we should do. I would simply add that word of precaution to not expand too fast and not attempt to cover too much ground, and let the future be marked by as healthy growth as the past has been.

Dr. W. C. Barrett of Buffalo: This seems to be a question of whether a part should be greater than the whole. I have always supposed this body to be a section of the National Association of Dental Faculties, and yet, the National Association in meeting has so much business to attend to that it is impossible for it to cover the ground of technology or of pedagogics; hence, there comes a necessity perhaps for something else. But it does seem to me that this association, or any association of its kind, should be careful and not get beyond the field which it can legitimately cover, for fear that it will so fritter away its energies that it will accomplish nothing whatever. If it confines itself to technology it will be of more benefit to the profession, more benefit to the colleges, more benefit to the students in the schools than it can by expanding itself through a policy of imperiousness. The members are gathered for a strict, definite purpose. I believe in holding to that purpose. It has accomplished good in the past. I believe if it holds itself strictly to one line of duty and cultivates one field thoroughly and completely that it will do much better than it will to skim over the whole field of dental pedagogics and so divide its energies that it will accomplish nothing especially in any particular one.

Dr. Theodore Menges of Chicago: I wish to say just one word on this subject. I have been attending the meetings of the National Association of Dental Faculties for about ten years. I have been a member of various educational bodies and have given nearly my entire life to the work of teaching. I have been disappointed in many respects with reference to the work as done and attempted by the National Association of Dental Faculties. There are to-day in the forty some odd schools in the United States, schools having bacteriology the first year; others will have it the second year; others will have it the third year; some the three years clear through. The same with materia medica and other kindred subjects. Now in taking up the suggestion as offered by Dr. Hunt, I do not understand that it is the purpose or the intent to say to a professor of chemistry or to a professor of anatomy, thus and so shall you teach, for if the professor or teacher does not instill his individuality into his subject and teach that different from what any other person would or could teach it, then that teacher is certainly not a successful teacher and never can be one. What do we want? What the National Association of Dental Faculties should have done (they could not, however, with the time allotted to them for the work that they had to accomplish), what they should do is to do what every liberal educational body is doing to-day. Let us regulate our course of study; let us know what we will take up the first year, what should be taken up the second and what the third year. And I tell you, gentlemen, as a liberal body of men and as educators, until the school men in dentistry take up these questions as they should have been taken up long ago they are neglecting one of the most important things connected with dental education in America.

Dr. S. H. Guilford of Philadelphia: I am afraid that either I did not properly express the thoughts that were in

my mind or they were misconstrued by the audience. I have been given credit for being a much greater expansionist than I really am. Now my idea is not that men should come here with papers prepared upon different subjects; my idea is not that they should write a treatise on bacteriology, anatomy, histology, etc., but that men should come here and tell us their method in a general way of teaching a subject. The great principle in teaching is to get fixed in the student's mind the thought that is in the teacher's mind. Some men excel in that line and some do not. Those who know how to do that thing well ought to come here and teach those who do not. That is the object. Last year the experiment was tried of having a sort of off-hand talk upon different methods of teaching by the members who were assembled, and when that was done Dr. Smith was one of the most enthusiastic men on the floor, simply because one man was giving his idea of how he taught students.

That was my idea; not to teach general subjects, but simply how to convey your ideas to the student.

A good deal has been said about this organization usurping the place of the National Faculties Association. I wouldn't want that to be done. But we all know that one of the main objects of the National Association of Dental Faculties has not yet been reached, that of teaching how to teach. If they don't do it somebody else must do it. And one other thought. This organization is composed of whom? Professors in colleges and the under men who are also teachers who are not members of faculties and who are not professors in colleges. Now these young men cannot come into the Faculties Association. These are the young men who are going to take our places one of these days. Let us give them the ideas that we have so that when they take our place they may do the very best they can.

Dr. Truman W. Brophy of Chicago: I desire to make a statement in line with what Dr. Menges said. I hold in

my hand a schedule which was prepared at the last meeting of the National Association of Dental Faculties by Prof. Taft, Dr. Goddard and myself. It is the aim of the association to have this acted upon at the next meeting. I say this because the association is not unmindful of the importance of having the course of instruction unified as nearly as possible. So this part of the work is being done by the National Association of Dental Faculties now, and the report of this committee will be made at the next session and acted upon, and I shall try to make it a special order and have it receive all the interest it deserves.

Dr. G. V. Black: I will detain you but a moment. First as to the remarks of Dr. Brown in regard to the subject which was assigned to him. I believe that was done understandingly. The subject was given to Dr. Brown understanding that it was beyond the subject of dental technics proper, and was done because of the general desire manifested by members of the association to hear discussions upon such subjects. And I had that prominently in mind when I spoke as I did of the fact that we are going beyond the subjects included properly in the title of our organization. We have other papers also that stand in the same relation to the subject of dental technics, that is, they are outside of that subject, and it is this seeming desire to discuss these subjects that has induced the executive board in the preparation of their program to include within it such matters as, notwithstanding the existence of these other organizations, teachers have not the opportunity to discuss elsewhere. The National Dental Association is an association that takes cognizance of matters of general interest in the profession, not teaching methods. It has never done so to any extent, and the conditions and circumstances are such that it is not likely to do so in the future. The conditions surrounding the Faculties Association are such as to make it practically impossible that they do much of

this in the future. They may discuss and are discussing questions of school management and the management of educational matters effectively and doing good work. But it is not a question as to whether they are doing good work or not; it is simply the question, can these discussions be had in that association. Another point that I wish to impress and emphasize is this: this being practically the only organization for the discussion of methods of teaching, we should be very careful not to go beyond methods of teaching in the subjects brought before this body. There is abundant material for discussion for years to come within these bounds, and the greatest care should be taken that we do not drag in other subjects in which men are interested. That will take up the time of this body to the exclusion of the discussion of the subjects it was organized to discuss.

THE VALUE OF A GRADED COURSE OF STUDY AND UNIFORMITY AMONG DENTAL SCHOOLS.

G. V. I. BROWN, M. D., D. D. S., MILWAUKEE.

In the evolution of our present system of graded study, the first step beyond the old-time plan of two five-months' terms, during which both first and senior classes attended the same lectures, and all examinations were given in one huge dose at the end of the brief period which usually comprised the entire collegiate instruction of the full-fledged D. D. S., was the annual examination for advanced standing.

With the lengthening of the course to three years' study came the necessity of dividing the branches taught so that certain studies and parts of studies should be the separate work for each year, but strangly enough, this extension of time and subdivision of work has brought little or no relief, for, as the horoscope widened and the possibilities of dental education became apparent, more and more studies were

added, better study and more thorough understanding has been, from year to year, exacted by our dental colleges, until to-day the freshman student is absolutely required to do as much hard work in one term as even the most exacting requirements made necessary in two under the old regime, and every conscientious teacher feels that twenty-one months is all too short a time in which to master the infinitely multiplying details, and the vastly widening science of dental knowledge.

The time for the adoption of a four-years' course may, perhaps, not be ripe, though the need is with us, four years must ultimately come, but in the meantime great good can be accomplished by the division of the curriculum in such manner as may most equally distribute the number of hours' work during each of the three terms, and a due consideration of the sequence in which the various branches shall follow each other, that, so far as possible, one may serve to prepare the mind of the student for better understanding of the next. This, I take it, is, briefly expressed, the true idea of the intent of a graded course of study, the underlying principle of all systematic education not, therefore, particularly applicable to dental education more than any other, only more apparent as the standard rises in the natural order of progress.

Undoubtedly a valuable factor in making possible that which we have gained has been the Association of College Faculties, and the formulation of rules for common regulation. In order that this alliance may exert its fullest benefit it is essential that uniformity shall prevail among colleges which are its members, with regard to their adopted courses of study, for it is obvious that, if, as the rules provide, students changing from one college to another are to be given advanced standing, frequent injustice is unavoidable to the individual, unless the studies completed, or the number of hours expended in the school from which the

transfer is given correspond, at least in a reasonable degree, with the one accepting him.

It would seem, therefore, for the reasons stated, and many others which might readily suggest themselves, that a uniform graded course among dental schools has become essential to a higher educational standard, and harmonious co-operation to that end is the vital question to be considered at this time.

Our attention is then demanded by the following propositions:

Firstly: What are the differences existing in the courses of study of all the colleges, members of the Faculty Association, at the present time?

Secondly: What changes are admissible in the time limit of the courses?

Thirdly: How far may it be practicable for colleges widely separated, and many of them governed under yet more widely different conditions, to come together and join in the adoption of the same curriculum?

The first broad division suggesting itself would be that during the freshman and junior years the study should be such as to best prepare the student for the direct understanding of operative and prosthetic dentistry, in his third year with all that pertains to the many forms of their practical application, leaving time for infirmary work unhampered, so far as practicable, by interruption incident to attendance upon other branches.

Anatomy, being the foundation for all medical and surgical science, naturally comes first, as upon its understanding reliance for after investigation must be placed. Osteology is logically the proper beginning of this study.

At the same time we find it necessary to take up the study of physiology in order that there may be a thorough comprehension of the functions of the body in general, with particular reference to the special parts to be under the

direct control of the student of dentistry, and this study properly begins with the study of the cell.

In order that this may be comprehensively and scientifically undertaken, it is immediately advisable that the use of the microscope be called to assist, therefore in its natural order we find ourselves forced to take up histology.

A step further and it is apparent that the study of digestion, the normal processes of secretion of the various organs will require a knowledge of chemistry. Hence chemistry is an essential part of all of the preceding branches.

Preparation for after operative knowledge is imperative, and for this purpose then the study of dental anatomy and operative technics is needed to begin the special training necessary for the dentist.

Again attention is required for the same special technic instruction in the other great portion of dental science, Prosthesis.

Thus all of these branches seem to be necessary during the first year, in order that each may in some measure assist the more complete understanding of the other and be, at the same time, a preparation for study of the second year.

Now it should be remembered that, in three courses of seven months each, which must, for the present, be our standard, there are altogether 3,888 hours, at eight hours per day, during which, under reasonable circumstances, the student may be expected to occupy himself in study, attendance upon lectures and laboratory work. Of this number, not less than two-thirds must be devoted to the operative and prosthetic branches. The balance then, sub-divided, is what remains at our disposal for all of the other studies and each must occupy only its proportionate share. Considering the vastness of each of these sciences it becomes apparent that the scope of the instruction must, of necessity, be limited to the essential portions which may be of greatest practical benefit, rather than a more extended study, which an ideal view would indicate.

The student of medicine, unhampered by many hours daily of special instruction and technical laboratory work, as is the student of dentistry, can more safely undertake a more extended study of anatomy. Moreover, his future duties will exact this of him, yet his knowledge of each particular anatomical part will not be called upon for the same degree of exactness as the dentist's in all that pertains to his own special field. The conclusion is then, that, though both may cover the same general course, less study and less accuracy of detail will be expected of the dental student, except in his own region. Therefore the head and neck must be the particular field of his special instruction, the brain, cranial nerves, respiratory system and viscera given more than ordinary care, while the extremities receive only sufficient study to give general familiarity.

To complete the study of osteology, and that portion of syndesmology and myology which relates to first year study, requires of didactic work, demonstrations and quizzes at least eighty hours, not including the dissection of one part, which should require about fifty hours in addition, a fair proportion of which can most profitably be devoted to quizzing as the work progresses.

The head, neck, viscera and respiratory organs should be dissected and given the most extreme care; this, however, would seem not to be so necessary in regard to the extremities, and, therefore, a little of the time can be saved to the advantage of the dental student.

Comparative anatomy should occupy fully twenty hours, also, not including dissection and mounting skeleton of lower animal.

What is true of anatomy in its different forms applies also to physiology and to the other fundamental branches, in fact it might be considered a cardinal principle in the education of a dental student that what he knows he should know more thoroughly and with greater accuracy and ex-

actness than the student of general medicine, but he does not absolutely need to understand as broad a field so thoroughly, and in the absence of sufficient time for study, concentration of energy must be depended upon to offset the large amount of time expended upon technical operations.

Physiology must claim at least two hours weekly and continue through both first and second years.

The histological laboratory requires an average of from two to three hours per week occupied in the preparation for and study with the microscope of normal tissues. This should continue at least through one term, accompanied by one hour per week of lectures upon embryology, general and dental histology, the second semester being chiefly occupied with a study of the tooth enamel, dentin and the tissues of the mouth.

The operative and prosthetic courses together take about thirty hours per week or 870 hours of the entire term.

A few hours per week even with a lower estimate of time would be needed for additional study, rest, attendance upon clinics, etc. Thus we have the freshman year provided for, leaving only two hours for incidental interruptions.

The question now arises, why is it that all these studies belong to the first year's work, and a review of the chart before you, together with a more extended study of the catalogues of different schools shows that nearly all have found it necessary to adopt approximately this arrangement, and that in a general way the time specified for each is nearly that which might be considered an average of the entire number as devoted to each special branch. The reasons why the experience of all has tended in the same direction are readily explained by consideration of the relationship of one branch to the other as already given.

To summarize the result, our first year's work and time devoted to each branch would read about as follows:

FRESHMAN.

Total seven months, thirty weeks, vacation three weeks, leaving twenty-seven weeks' attendance.

Total hours, twenty-seven weeks at eight hours per day, 1,296 hours.

	Hours.
Dental anatomy, operative technics (15 hours), with prosthetic technics (15 hours), 30 hours per week.	810
Anatomy	80
Practical anatomy (dissection)	50
Comparative anatomy	20
Physiology (2 hours per week)	54
Chemistry, 3 hours per week (including laboratory)	81
Embryology	...
General and dental histology, 4 hours per week (including laboratory)	108
Materia medica, 2 hours per week	54
Balance	2

The junior year presents the necessity of completing the work in those branches unfinished in the first year, and additional preparation for the third.

A study of brain, nervous and respiratory systems is the natural associate of surgery, while bacteriology and surgery are inseperable companions.

Physiology and chemistry, each in an important way, attend upon a better understanding of those variations from normal processes which we recognize as pathologic, and for the study of which the completion of histology has made preparation. Pathology then comes in its proper order at this time.

Orthodontia is imperative in the light of necessity for practical work and readily supplants comparative anatomy, its near relation. More advanced technics and instruction

in prosthetic and operative procedures, together with didactic and infirmary work in both these branches, give final preparation for the senior year.

The division of this work would be about as follows:

JUNIOR. SECOND YEAR COURSE.

	Hours.
Anatomy	80
Practical anatomy	50
Physiology (two hours per week)	54
Chemical laboratory (three hours per week)	81
Therapeutics (one hour per week)	27
Prosthetic dentistry, didactic (three hours per week)	81
Operative dentistry, didactic (three hours per week)	81
Orthodontia, didactic (one hour per week)	27
Oral surgery, didactic (1 hour per week)	27
Pathology, didactic and laboratory (three hours per week)	81
Bacteriology, didactic and laboratory	54
Prosthetic technic and prosthetic clinical instruction (eight hours per week)	216
Infirmary work (a little less than fifteen hours per week)	405
	1,284
Balance unaccounted for	22

The senior year should find the student thoroughly prepared for the study, per se, of operative and mechanical dentistry. Technic instruction and infirmary work ought to have made him so familiar with principles, and the manner of performing various operations, as to admit of a proper sense of discrimination between methods and materials, and in order to better understand the nature and physical characteristics of the metals he is to use, metallurgy may now be taken up, to the best possible advantage.

His acquired understanding of pathology and the preparation of pathologic specimens in the laboratory, as well as knowledge of the use of the microscope, now applies in the study of pathologic conditions of the mouth and jaws in relation to the operative procedures necessary for their treatment. Therapeutics emerges from its theoretical atmosphere and becomes the associate of practical experience, and it would seem as though the happy combination in this course might be to borrow from the medical practitioner something of his wider knowledge in the treatment of general disease, sufficient at least to familiarize the student with writing prescriptions, the use of anesthetics and a selection of at least the best drugs from each classification, upon which he shall be so thoroughly grounded that there may be no hesitation or question with regard to his ability to prescribe some one or more of the best as intelligently as any graduate of medicine. In doing this, those remedies which he uses in a more local sense and which are his daily companions must not be overlooked, yet the narrowing of this course down, as is so apt to occur when only the dental aspect is given, to the essential oils and those comparatively few remedies which are daily used at the chair, is quite insufficient to the broad education which should be demanded. Oral surgery is of course required. Asepsis, treatment of wounds and the general principles upon which all surgery rests, having been instilled during the junior year, those operations which concern the mouth, the face, and the jaws can be explained and demonstrated to minds receptive and prepared for their proper understanding. In prosthesis, the use of porcelain work and those higher principles which govern the application of crown and bridge work must be given as a fit rounding off of the training which has gone before. At a fair estimate it would seem as though not more than 486 hours should be given to didactic work in the lecture room in this year and

the remaining 810 hours be devoted to practical instruction in the infirmary, laboratories and attendance upon clinics.

In the treatment of this almost limitless subject the temptation is strong to follow along some one or more of the channels open for suggestion and discussion, especially in view of many interesting thoughts received from teachers of different schools in the correspondence incident to collection of necessary data, chiefly with regard to methods of teaching, and also to discuss more in detail the subdivision of different branches into separate chairs. But it was thought best to keep strictly within the limit of the title as well as the limitation of practical views.

[The chart referred to by Dr. Brown and those who discussed the paper consisted of a tabulated list of hours spent at each college in the pursuit of the various studies. Having been made up from the catalogues of the schools, it was claimed by those present to contain many inaccuracies, and some time was spent in making the changes desired by the various school men. The Publication Committee tried to get a copy of the corrected chart from Dr. Brown, for insertion here, but without success.]

Dr. M. T. McLain, Cincinnati: Mr. President and Gentlemen—The honor that has been conferred upon me to enter into this discussion is beyond my comprehension to account for. In the first place, I had a copy of Dr. Brown's paper handed to me one hundred and twenty-one seconds ago and I am not competent to discuss a paper of that magnitude in that length of time. And I want to say that the vocabulary and experience in teaching, as well as understanding the classification of studies in dental schools of the gentlemen who will follow is sufficient to take up the rest of the afternoon if they do themselves justice. I thank you for your attention.

Dr. E. C. Kirk of Philadelphia: I am in a worse predicament than the gentleman who preceded me. I have not seen a copy of this paper. In the first place I want to state that I am very grateful to Dr. Brown for calling attention to the errors in our catalogue. We shall endeavor to do better in the future. I quite agree with him that the catalogues which are issued by the colleges do not, as a rule, fully represent the work that is being done. I include our own institution in that category. It is a very difficult matter, as anyone who has had experience in the production of catalogues will know, to produce an exhibit which will fairly show what is being done at the institution.

The question before the assembly, as I understand it, is on the value of a graded course of study and uniformity among dental schools. It seems to me that we are discussing what is a self-evident proposition. There can be no question in my mind as to the value of both of those propositions. Therefore, what we want to determine here is not so much whether uniformity is needed, but rather to get at the best method of producing it. I would be very far from claiming that the system of instruction which we carry out at the University of Pennsylvania is an ideal one. I would not even go so far as to say that I am satisfied with it. But it is up to date and the best that we are capable of doing, and perhaps I can be of more use by giving you the principles upon which that system is based. I am entirely in agreement with the proposition laid down in Dr. Brown's paper that the subjects of anatomy, of physiology and of chemistry should form the foundation of the whole course. I think he has said as much as is necessary with reference to the importance of anatomy and physiology. I think he has scarcely emphasized enough the importance of thorough chemical training. It is true that a preliminary knowledge and understanding of chemistry is necessary to a comprehension of what comes later in physiology and

pathology, and I am hoping that the time is close at hand when a knowledge of the elements of chemistry will be made a necessary prerequisite for entrance upon the dental course. It is a matter of regret to me when I am presenting a chemical problem before the class that I have to stand before those men and explain to them the functions of a chemical equation. It seems to me that that is a knowledge which should be a part of the working equipment of the students when they come to us and should be made one of the elements of the preliminary requirements, as well as a knowledge of the elements of physiology. A question has been noted by Dr. Brown that the first year under this plan is more or less overcrowded with work; that is, with elementary anatomy, which involves also osteology and histology, and with chemistry and physiology. As a matter of fact, in the University of Pennsylvania the first year is not only the hardest year absolutely, but relatively; we admit that, but at the same time it is not without its advantages. It enables us right in the beginning of the course to determine pretty accurately the quality of dental timber out of which we are proposing to make practitioners, and if a man goes through our first year sucessfully we are almost sure that he will do well in the balance of the course. We regard the first year as a screen or sieve, as it were, through which we pass this crude material, and if it comes out on the other side in the junior year we feel pretty safe about it. Our course shows that not less than thirty per cent. are conditioned in some one or more of the subjects of the first year. I have already stated my approval of the putting of these elementary subjects in the first year and I simply mention it again to emphasize my approval of it.

With regard to the lack of uniformity in the curriculum as among colleges. That has been said to work a hardship. I am not quite clear as to how it works a hardship. If, for example, a man comes to us for advanced standing and has

not completed chemistry; we will say he comes from a school in which chemistry is final in the senior year. That man has not passed chemistry and is simply given a transference of that study to his senior year and he is taking no more work than he would if he had remained in his own college; but, as a matter of fact, he is conditioned in our freshman chemistry. The question of the character of the curriculum seems to me to be more important, and correspondingly what it shall contain, than these questions of differences in the arrangement of the curriculum. I don't know that I have anything further to say on the subject at this point.

Dr. J. Taft, Cincinnati: It seems that this paper and the chart both contain merely a statement of the present condition of the schemes of study in the different colleges. The matter of a graded course of study seems to be in a process of verification, or rather preparation by the different schools. There is a tendency now for all of the schools to adopt a graded course. There is a difference between different schools with reference to this matter, some having what they call a graded course that really is hardly entitled to that name, and quite a number of our schools are using a graded method, grading their subjects in the first, second and third years. Some have them graded with reference to the half years. There is no question that in dental teaching, as in other educational instruction, the graded method of teaching and of study is far better than that formerly employed, when in a large number, especially in schools of dentistry and medicine there was no attempt whatever at grading, simply taking the whole subject and giving courses of lectures through each term, and this was more especially true when two years were occupied rather than three, taking the whole list of subjects and going over them twice during the two years, which was certainly a very defective method. It occurred by and by that to separate these and

give a proper amount of work to each student in each year, or each semester, and require that certain attainments be made upon these was a better method. That having been adopted to a degree has proven its value and its importance. There is no question upon this subject, as I suppose. Some have thought it difficult to adopt a graded course, others have readily taken it up and have made it successful.

Another question that is quite as important as this, it seems to me, in certain aspects, is that of uniformity in the curriculum of different colleges; devising a curriculum and arrangement of subjects that should draw out the best efforts of the student and secure the highest attainments in the course. The paper refers to it, but not fully. Of course, that was hardly within the scope of the paper. But that there would be a great advantage in a uniformity of the curriculum and an arrangement of the studies that constitute the course, there can be no question. It would enable the student to accomplish his work better, and especially where he is transferred from one school to another it would remove many of the difficulties that now stand in the way, as all can see who have had experience in this particular. A student comes from one school and the question is asked: What branches were embraced in your first year's work or in your second year's work? and he specifies what they are. The reply is made: That does not correspond with our course at all and we must adjust the matter. And perhaps when that is done it is not satisfactory to the student and possibly not satisfactory to the faculty from which he came. And so difficulties of this kind have existed in the past. But a uniformity and arrangement of subjects that should be usable in all the schools it seems to me would clear away all difficulties of this kind, and would be more satisfactory to both the student and the faculties of the colleges interested in the particular case. This seems to me to be a very important matter and one which should receive

special attention. It has already received attention in the National Association of Dental Faculties and a committee was appointed a year and a half ago; but little work had been done at the last meeting of the association in May and the committee was continued for the present year. It is to be hoped that a beginning may be made by the committee this year with reference to that work, but it is not inappropriate, of course, that it should be taken up here and discussed, for all these questions will assist very much in arranging a curriculum and placing the different subjects where they ought to be in the course and giving the time to each that they ought to have, the time that can be afforded or given to each branch relatively with the other branches that make up the entire curriculum. These are questions that must be adjusted by somebody, and it would be well if those subjects would be in the minds of and studied by the various members of teaching faculties of the country. And I am sure the committee will be glad of any suggestions with reference to the matter. Of course, there are certain things that appear self-evident, almost upon presentation; for example, anatomy, chemistry and physiology are foundation studies. With these the student must begin; others are added and a given amount of time should be allowed to each one to enable the student to master the different subjects as thoroughly as would be indicated in the course, and as would enable him to best equip himself for the performance of his work in the profession after he enters it.

Dr. T. W. Brophy of Chicago: Inasmuch as the question before us is the consideration of the methods of teaching, will you state what year, in your opinion, the course of operative technics should be taught?

Dr. Taft: It should come in the second year. That is my opinion. And it should be so provided for sufficiently to enable the student to have the manipulation; his work

upon teeth in the preparation of cavities, his work and special examination of the teeth (that should come in connection with histological work), and his finger skill so developed, so elaborated that when he goes to the mouth he will be able to accomplish the work in an acceptable manner; that is, it shall be void of many blunders and mishaps which are made at times. He should have this initiative preparation in finger skill and a knowledge of the various parts of manipulation that will enable him with a good degree of intelligence and skill to take hold of his patient and accomplish his work. Even after all that is attained there is enough for him to learn in the mouth. This matter of acquiring finger skill in the mouth is only a beginning, really, of the work which he has to do. He looks into that mouth and he finds certain conditions, he finds certain classes of teeth, he finds evidences of disease and certain things which must claim and have his attention during his third year of work, and he ought to be prepared so he could give a large share of his time in his third year to this particular work and not have his whole term confined to mere manipulative work, how to fill this tooth and what shall be done with this in a manipulative way. His attention during the third year should be directed always to the conditions in the mouth rather than to be wholly absorbed in the manipulative work, and he should be so prepared in his second year that when he goes into the operating room he will be in a good degree of preparation for a good degree of this kind of finger manipulation.

Dr. N. S. Hoff of Ann Arbor: As a member of the program committee responsible for perpetrating this joke upon this body I want to make an apology, and yet, I don't want to make any apology, because I think that we builded more wisely than we knew; we selected a man who had the grit to hold up the mirror to show us ourselves as we are. There was a thought in the minds of the committee that he would

present this subject from the pedagogic standpoint, but he has presented it in such a way that some of us feel that it has not much to do with pedagogics, and he felt so himself this morning when he made such apologies as he did to Dr. Black. I did not know what he was driving at at the time, but I can see it now. But he does not need to apologize at all, because he has brought out the point that we want to bring out. There are three essentials that we must consider in conducting any kind of a graded course of study. First we must decide what we shall teach; then we must decide when we shall teach these different subjects. But the essential feature that interests this association from a technical standpoint is how we shall teach these subjects, and we must decide when we shall teach them before we know how to teach them. We want to decide what to teach, when to teach it and how to teach it, and if the members of the Faculties Association will tell us what they want taught we will try to help them to decide when to teach it and we will decide for ourselves how to teach it. That is what we want to get at. There are a number of subjects that must be taught in regular systematic order. The point that I want to get at is, which subject shall we teach first; which shall we begin with? I think it is the general consensus that anatomy should be taught first. We must know anatomy. Then what else shall we teach? Some say physiology. I say not. I say chemistry. I say anatomy and chemistry are the two basic studies. They are fundamental, they are essential, they must be taught first. If we teach anatomy in all its different directions, if we present that subject thoroughly the first year and get our students well grounded in anatomy we have done well. If the student has some time that he can devote to chemistry and we can teach chemistry well, we can do that. If we can then add histology or physiology, well and good. But my notion is that we fail in our teaching from the fact

that we attempt to do too much, we attempt to teach too many branches or subjects in any given year. We begin by overloading our first year, as expressed by Dr. Kirk. He acknowledges that the first year in his school is the most difficult, and so it is in almost every school. All this thing has got to be adjusted, and what I want to get is the opinion of the members as to what we shall teach first. If we can get your ideas of what should be taught the first year we can begin to discuss ways and methods of teaching that particular branch. It seems to me that we can make progress if we can discuss this first year work, and then we can talk about how we shall teach it.

Dr. W. C. Barrett of Buffalo: I think that this is a subject which should not have been brought before this association. It should have been brought before the National Association of Dental Faculties as that has exclusive control, or should have, over the general schedule of teaching. It is utterly impossible for anyone to make a complete chart with any kind of justice which shall represent any school from the schedules that are sent out, and this without prejudice to the schedules themselves, because it is utterly impossible in some studies to place them properly upon the schedule. For instance, bacteriology and histology and dental histology. Now those cannot possibly be classified so as to do any school justice unless they teach them separately in separate years. Most schools, so far as I know, teach histology as a study, and this is applicable to general histology and dental histology, and all upon the same schedule. It does seem to me, then, that the presentation of this subject, in the first place, should not have been before this society. In the second place, it is impossible to make such a chart to do justice, and in the third place I would say that the consideration of it should be confined to certain things. As Dr. George Hunt says, we can't cover the whole thing. Now I find, according to that chart, that

twenty-four schools teach operative technics in the first year; five schools teach it in the second year, and Buffalo does not appear to teach it at all, and yet it has in the second year two hours every afternoon through the whole course devoted to operative technics. Now I cannot conceive that operative technics should belong in the first year. There are a number of reasons. Prosthetic technics should precede operative technics; the mechanical portion should precede the operative portion. As soon as a student is able to devote his time to operative work he neglects the first for the second. The operative work presents to him certain attractions which the prosthetic work does not, and as does the average practitioner, he rather despises the mechanical part of it. Whereas, mechanics and prosthetic dentistry form the base upon which all practical practice must be based. Hence, I believe that it is wise and judicious that no operative work be introduced in the first year at all, although twenty-four schools as compared with five teach it in the first year. I believe it is all a mistake. We all know that if two students are placed side by side, one the junior and the other the senior, or one the freshman and the other the junior, that the freshman will neglect his work always for the junior work. He will not be satisfied with his work. Like a boy he will be trying to be doing men's work. Hence, I cannot but think that it is all a mistake when those two are mixed together. I think that is a point that cannot be too strongly made and that we should have thorough interchange of opinion upon that one thing.

Dr. G. V. I. Brown of Milwaukee: Now that the sky is somewhat clear I would like to say just a few words so that this subject may be intelligently considered. It is no part of my affairs whether this belongs here or not. It was assigned to me by those in authority, therefore, as the butt of this joke I took upon myself the work that has been given. I realized after a few days and nights that it

was utterly impossible for me to get up a chart that would adequately represent this thing. I decided once to give it up, but I heard about that time that the National Association or its associate associations had reported on this subject about a year and a half ago and had made no progress. I made up my mind that this association would also report no progress unless the definite facts were brought before this meeting. Therefore, I took the matter up and gathered from the catalogues the best data that I could get. I corresponded with the deans of the colleges and got what I could get. Now it doesn't concern anybody particularly whether the fault is mine or my stenographer's or the young man who made the chart, or the colleges. I am perfectly willing to divide with the colleges the responsibility for errors. I am perfectly willing to admit that there are several errors. There are certain errors that are purely clerical errors made in transferring the figures to the chart. The matter of deciding the point which Dr. Barrett has spoken of as to whether these studies were classed as special separate courses, of course, was a matter which I could not go into. Now I felt that it was certainly beyond any right which I possessed as a teacher of a few years' experience to come before a meeting in which men were sitting who had been teaching for twenty or more years and even assume the proper arrangement of this course. But I did assume to take the calendar and find out how many days there were in a year. Another question was to find out how many hours the average student would study. I could state with reasonable accuracy which of these branches were associated and dependent upon each other; therefore, I could take the number of hours at my disposal, subdivide those hours as well as I could and give you simply a working schedule. My intention was to have had this put up early and to have given all who were present an opportunity of coming up and correcting the schedule. Now, if this mat-

ter belongs to this association and you care to do anything with it I think I can advise you how to do it. The time that I put on this I think has opened my eyes to that fact, and I suggested to one or two of the gentlemen that if anything were to be made of this at all it would have to be done by taking each study one at a time and discussing as to which year it properly belongs in. If it belongs here I should suggest that as the proper way to treat it. If it does not, excuse me from responsibility.

Dr. J. Taft, Cincinnati: I would like to correct an impression which might go out, which is simply this, that this subject has been under consideration for a year and a half and nothing done. It has been under constant consideration all the while and somewhat of an outline of the work has already been prepared. There was nothing special to report at the last meeting of the Association of Faculties, but they reported progress simply and asked for further time, and the committee was enlarged. The plan that has been under consideration was simply such as Dr. Brown referred to in his last remarks, taking up a certain subject. Take anatomy. How much anatomy ought a dental student to have, as much as physiology or not? How much time can be devoted to that particular study? General anatomy, regional anatomy, dental anatomy, comparative anatomy, or what not. These are questions that come up all the while and they are questions that are under consideration.

Dr. G. V. I. Brown: I would like to state that I did not intend to convey the impression that the gentlemen who had this work under consideration would not accomplish anything.

Dr. A. O. Hunt of Omaha: I can sympathize fully with Dr. Brown under the present circumstances. Some years ago the statement was made that the Faculties Asso-

ciation had not paid very much attention to this subject during the session of 1888 or 1889, I forget now just which year; but at any rate a committee was appointed the previous session for the purpose of finding out the methods of teaching in the various colleges in order to arrive at some conclusion upon which to base a system of graded instruction. I was the one who did the clerical work of that committee, and like Dr. Brown I took the catalogues, and I also wrote to members of each college to get their lecture cards. I, however, took another plan. Instead of presenting the number of years in which the subjects were taught I presented the number of hours given to each subject. Like Dr. Brown, when the chart was put up before the Faculties Association I thought at first I would look for a door. The air was blue and quite a number felt as Dr. Barrett did to-day. But the chart that I put up there was correct, barring the clerical mistakes which were almost unavoidable. Now I partially agree with Dr. Barrett in this, that I don't think this subject should have come before this body, but it is here and I am glad of it because it is going to help in the solution of this problem. The result of the schedule that I presented to the Faculties Association, the one resolution that had any value on that work at all was this, that a resolution was passed requiring that each college should teach during two courses the fundamental subjects, like anatomy, physiology, materia medica and so on. Aside from that no other good result came from it. Now I doubt whether there is anybody in this room who can even now take their own college and correct that accurately. This chart gives us the years in which these subjects are taught. We ought to know the number of hours that are consumed in teaching these subjects. This is not an easy matter to get at. One gentleman may teach two subjects. For instance, he may have physiology and histology. You will find the teacher's name at a certain hour occurring all along

through the course. Part of the time he is teaching one subject and part of the time another, so that he does give the whole time laid down on that schedule to either one or the other subject.

Now, as this is here I am one of those who believe that we ought to keep it here, straighten it out, act upon it, add to it and get something as a basis upon which we can go as a technic association. It is not fair to say that this one or that one has not done any work on this subject, because there has not been an hour since 1884 that the sole idea of those bodies has not been to raise the standard and elevate the methods of teaching. Now this has taken a long time; colleges have changed, the time of teaching has been changed, until now we are right on the eve of another change, so, that all these things must be considered. But this chart, I think, supplemented by the number of hours consumed in each school on each subject, and this corrected and published with the transactions of this association will be a great step; it will tell us just what the majority of schools are doing with any particular subject. We have certain subjects that all the colleges teach; some that all do not teach. For instance, all do not teach dental hygiene only as it accompanies some other subject. And so with bacteriology; all schools do not teach bacteriology in the sense that it would make a study by itself. But there are other subjects, such as anatomy; all the schools are teaching that. When we get a chart representing the year in which these subjects are taught and the number of hours devoted to each subject, then I think we will have a base upon which to formulate something in the way of grading courses of instruction. Until we get that nothing will come of it, and I would suggest that the representatives of each school here would take these subjects home with them and report to Dr. Brown a correct condition of things as they exist in their school, supplemented with the number of hours consumed on each subject.

Dr. J. P. Gray of Nashville: While the chart is not correct, yet it shows conclusively that we are not all together in the matter of teaching. But I do not conceive that this is of very much importance. What we are driving at is to teach the students dentistry and medicine. If I don't teach just like Dr. Barrett does, and yet I give the students a comprehensive idea of anatomy, that is sufficient. I don't care whether Dr. Barrett's students come to me or not; I would rather they did not, and I know I do not want my students to go to him. I believe they can get better instruction in my school than they can in his. I say this without any reflection upon him. I believe that a student who has started in at Dr. Barrett's school can get better instruction by staying there than he can by changing to the University of Pennsylvania or any other school.

Now with reference to the teaching of prosthetic and operative technics. I do not agree with Dr. Barrett. I believe that the two ought to go hand in hand. There is too much of this idea prevalent among students that operative dentistry is the thing and they want to get onto it right away, and the reason we have that idea prevalent with the students is because we do not give that attention to prosthetic dentistry that we ought to, and never have done so; that is, I mean we do not exalt it as we do the other. If we take up prosthetic and operative dentistry and put them hand in hand we will obtain better results by far, and the student goes out feeling that there is something in prosthetic dentistry besides mechanics.

Dr. E. C. Kirk of Philadalphia: May I have the privilege of a few moments to add something that I overlooked? It seems to me that the point which Dr. Hoff made, that we are to study the when and the what before we study the how, is a very important consideration and has not been sufficiently dwelt upon. I thought perhaps you might gain some clear idea of the what and the how by calling atten-

tion to the University of Pennsylvania department of dentistry, which, in common with other departments of universities, is in a somewhat different position from the schools that include within their faculties representatives of all of the branches of the curriculum. I take it for granted that in all dental colleges which are departments of universities the instruction is carried out upon the university idea, and the university idea, as I understand it, is to centralize the instruction in any branch at a given point. When we teach elementary anatomy, it is taught to every student that wants to take anatomy. If he wants anatomy he goes to the department where that particular branch is taught and he takes that branch and passes his final examination upon that branch. That we regard as elementary anatomy. So also with chemistry; so also with physiology. That is to say, the university has recognized that certain elements of the curriculum are elementary. Under that system the department of dentistry becomes a department of specialized instruction. It is not wholly that, but that is the tendency. Our dental students get just the same sort of anatomy as is given to the medical students, and when they are sufficiently advanced in that portion of the curriculum they take special anatomy, and that is the idea that we are trying to develop in all the branches of our curriculum. There is another division that must be borne in mind; that is, there are two phases of dentistry, the scientific and the art side of it; the knowing how to do and the doing of it, and there are branches which are fundamental to both of these main divisions. I can see no reason why there is any difference in the character of manual skill that is necessary to properly shape a piece of metal into a plate or a crown and the skill that is required to properly shape a cavity. It seems to me that the manipulative ability required in one operation is the same as in the other. And for that reason I see no reason why we should not have

those two branches, operative technics and prosthetics, going hand in hand. I see no reason why the operative should precede the mechanical or the mechanical should precede the operative.

Now, as to where they should be placed in the curriculum. I am not in agreement with the idea that they should be placed in the middle of the course. The mouth should be the field of study for the dental student. The more he is brought in contact with the mouth and all its various conditions, the better dentist he will be.

Dr. Truman W. Brophy of Chicago: I do not wish to discuss this subject, but I would like very much to see the discussion fall into the channel of practical work; that is, I would like very much to see the discussion from now on confined to operative and prosthetic technics, and prosthetic dentistry. I think if we do that we will be able to get more out of it. Now there is a question as to whether it would be better in the colleges to teach the subject of operative technics in the first or second year. That is the question before us now for further consideration, and it seems to me that if we can get an expression of opinion from the gentlemen here who are engaged in teaching these two branches that it will be of very great value to us. Prof. Taft has made the statement that it is his belief that operative technics should be taught in the second year; other gentlemen have stated that it, in their judgment, should be in the first year, and that is where we stand. We haven't it settled and we don't agree on that point. If you will look down the department of operative dentistry on that chart you will find quite a number of colleges teaching operative dentistry. Whether that means practical operative dentistry or didactic instruction, we are unable to obtain from looking at the chart. And you will find that nearly all of the colleges are teaching prosthetic technics in the first year; in two or three they are

teaching it in the second year, and in my opinion there is no subject to-day before the colleges so important as this subject of unifying the course of instruction. And I am highly pleased that Dr. Brown has brought this matter here, because we will get at the subject and we will be able, I think, to come to some conclusion as to what the general opinion of the men is who are engaged in these practical departments, or the foundation which leads up to the practical work.

Dr. N. S. Hoff of Ann Arbor: I suggest in connection with this that we have a kind of experience meeting for the next few minutes. Let each one get up and tell when he teaches operative and prosthetic technics, and why.

Dr. G. V. I. Brown: I might amend that suggestion just a little bit. This paper should properly be operative and prosthetic tèchnics in relation to the other studies. Without enumerating the others, if you will just simply say how much time you give to that work we will know just about how much is left for the others.

Dr. J. B. Wilmot, Royal College of Dental Surgery, Toronto, Canada: I am very glad that Dr. Brown has presented this subject here, for the reason that it enables me to see at what a disadvantage I have allowed our school to be put with comparison with the announcements of some other colleges, and I think I may say that another year we will not be at that disadvantage.

It seems to me that the question of what should be taught in the first year must be governed by two conditions; what is desirable to teach in the first year and what we can get time for in the first year. Our difficulty has always been to prevent the second year from being the hard year, and I believe that is the difficulty in most schools that are not connected with universities. So that in arranging our first year course we have had partially in view the idea of

relieving our second year. I have been a little amused at the attempt by representatives of the colleges to justify the course that they are pursuing. I cannot conceive of Dr. Barrett taking the line of argument that he did for any other earthly purpose than to justify his action, that operative technics should be in the second year.

I presume the question that is now before us is as to when we take up this technic work. We take operative and prosthetic technics in the same year; we take one in the morning and the other in the afternoon, and for the reason that we think it wise to carry them on together.

Milwaukee Medical College (Dental Department): The Milwaukee Medical College teaches operative and prosthetic technics in the first year. We give an average of about ten hours a week to each. I think relatively the hours are exactly eight and nine hours under the instructor's direction, and there are one or two hours more which those who work slowly are allowed to utilize in order to keep up with the class.

Now I would say that I am personally firmly convinced that men cannot too quickly begin to deal with living tissue. I believe just as much as anyone that they are not fit to do so until they have this technic work in its fullest extent, but the sooner they come in contact with the patient the more practice they will have and the better dentists they will be. On the other hand, there is another reason which represents more to me perhaps than to others, but I am sure those who are connected with medical colleges will appreciate the point which Dr. Guilford has been emphasizing, that men are taking too much without regard to any particular natural ability that they may have. Now I make a practice, and I hope others do too, of telling a man at the end of his first year, if he does not develop the necessary ability to become a dentist, to go on and take the

medical course. As the courses are arranged we can do that, and I think I have done that man a kindness.

Cincinnati College of Dental Surgery: The first three months is devoted to prosthetic technics and the second three months to operative technics; from one to five each day in the afternoon and from eleven to twelve in the morning. The lectures run from eight to eleven each day, and immediately following that the technic work goes on.

Dr. Hoff, University of Michigan: We teach prosthetic technics during the first year for 34 weeks, five hours each day, 25 hours a week. We teach prosthetic technics for six weeks during the second year, five hours each day. We teach it in this way because we believe prosthetic technics is a fundamental study, and that we can determine better in teaching prosthetic technics whether a man has mechanical skill sufficient to become a good dentist or not. We teach operative technics in the second year, seventeen weeks, three hours a day. We teach it in the second year because we do not allow a student to operate at all until the third year, so it is not necessary that they should have this operative technics sooner than that period.

Dr. Barrett, University of Buffalo: We teach no operative technics or operative dentistry in the first year. The lectures to the freshman class are in the forenoon; in the afternoon they work in the prosthetic laboratory. The professor of prosthetic dentistry goes down and spends about one hour each day, taking them in separate classes a few at a time, and demonstrates and teaches mechanical technics, the manufacture of instruments, the forging of steel and things of that kind.

Operative technics are given in the junior year, three hours each day until the course is completed, and some of them get through with it sooner than others. Usually our course is thirty-two weeks and usually about twenty-two

weeks are given to operative technics; three hours each day in the afternoon. Then at the end of that time they are introduced into the infirmary without engines, simply to do the elementary portion of the work. Operative dentistry, then, does not come in until the second year, because we have got all we can do in laying the foundation first, and in building our building we do not lay the topmost brick in the building first. Dr. Wilmot seems to have no other idea of urging this than to carry out an argument. I am inclined to think that if he will compare ideas and compare results he will get another idea into his head.

Dr. Foster, Southern Medical College: The dental department of the Southern Medical College devotes four hours each day in the freshman year for two months to prosthetic technics. Following that they devote the same time for two months in operative technics. The latter part of the first year they are allowed to do minor operations in the mouth.

Dr. Milligan, University of Pennsylvania: We have a class of 180 freshmen. That class is divided into two sections. Each section is subdivided into other sections. I take two of these sections and the demonstrator of prosthetic dentistry takes the other two. We give each the same amount of time during the week to our respective sections. For instance, one of my sections will work on Monday for two hours and on Wednesday for two hours. My other section will work on Tuesday and Thursday, two hours respectively. They go on in that way from the first of October until they have finished, which is sometimes not until the 18th of January. If they do not get through by that time they must come in during the time occupied by the section that comes in after the first of the year and finish their work. The section which I get after the first of the year is compelled to work until they have finished their work, if it takes until the first of June.

In regard to technics. I most decidedly think that as soon as a man gets into college the instruments should be put into his hands. I remember when I first went to college we had no such thing as technics, preparation of cavaties and how to fill them, and I was actually afraid to take hold of an instrument, until one day the demonstrator came to me and said, "See here, you are not doing anything here, come and take a patient." I protested at first, but he insisted and so I went and took the patient, but had I been put in a technic room and had the fear and timidity taken from me it would have been a great deal better for me. Now I take my men, after having lectured to them, of course, and explain the use of their instruments to them, give them a couple of teeth and make them prepare cavities in them. I make them take their chisels and work at that tooth, holding it in their hands, and in that way make them cautious about letting their instruments slip. I most decidedly think that the sooner a man is put to work in the mouth, after the rough edges are taken off, the better for him.

Birmingham Dental College: The Birmingham Dental College teaches operative and prosthetic dentistry in the first year, prosthetic first and then operative, devoting two hours a day until they have completed all that is required of them, and we think it is better to take them along in that way. They will work at prosthetic technics until they get tired and then we change them over, and continue that until they are thoroughly done with those branches and then we put them to work on the practical.

I want to thank Dr. Brown for bringing this chart out. It shows us up as others see us and I think it will make us all more careful in the future, and we will go home and we will teach better and we will have some system in what we are doing.

Ohio College of Dental Surgery: In the Ohio College of Dental Surgery operative and prosthetic technics are both undertaken and completed in the first year. Three hours in each of these branches is given to didactic work, and a lecture course to be completed during the year is posted at the beginning of the term. The prosthetic laboratory is open to the freshman students during the entire session, and when the student is not busy with practical cases of prosthetic dentistry he is expected to be at work on his prosthetic technics in the laboratory.

The same is true of the operative department. A lecture course is laid out for the year, and while the student has three hours of didactic instruction in operative technics he nevertheless is expected to spend a number of hours when he is not busy in the operative technic department. There is a course of technics also in crown and bridge work which is undertaken and completed in the first half of the second year. A course of technics in orthodontia is also undertaken by the student in the third year, and in crown and bridge work, and in orthodontia technics the work is expected to be done the first half of the second and third years respectively. Until a student completes his work in crown and bridge work technics he is not allowed to have a practical case. That plan has been found to be an excellent one. The student brings his work up promptly and when his work is accomplished he receives a practical case of crown and bridge work. The same is true in orthodontia.

Dr. W. E. Harper, Northwestern University Dental School: In Northwestern University the technic work is taken up the first year and carried right through the term, three hours a day three half days a week, making practically nine hours a week. I look upon operative technics as elementary operative dentistry. In my opinion you cannot lecture intelligently upon operative dentistry to

students who have not had a good drill in operative technics. In operative technics you take up the anatomy of the teeth which is necessary in a full description of these operative procedures. You take up the nomenclature of the teeth, you take up instrumentation and instrument nomenclature, and you take up classification and cavity nomenclature. In other words, we give the freshman student a foundation in his first year. You will notice from that chart that every institution commences lecturing on operative dentistry in the second year. A student cannot well grasp the situation in the second year in operative dentistry unless he has had operative technics in the first year. It is purely elementary operative dentistry and for that reason I feel that its place is in the first year. Again, I would place it in the first year for the reason that possibly eighty per cent. of the work that the average practitioner is called upon to do is operative in character. I would place it there, again, for the reason that there is nothing in dentistry, as I see it, that is so difficult to acquire as manipulative skill, and manipulative skill can only be acquired by experience. It means a long, persistent, determined, continuous effort, and if you begin in your first year you will have a better chance of accomplishing results. I would place it there again because a great part of the pain of operative dentistry is due to a lack of the appreciation of operative technics. To me it has no other place. Of course, that is simply my humble opinion. The student is confined in the operative technic room until he has passed on dental anatomy, cavity nomenclature, instrument nomenclature, and so on. His mind is put in a condition so that when we come to talk of operative dentistry he can follow us a great deal more intelligently. There is no clinical work done by the freshmen in the first year. I am not prepared to make a statement in regard to prosthetic technics.

Dr. Dale, Vanderbilt University: We complete operative technics in the first year. Prosthetic technics extend through the entire first year and a half of the second year. As it is taught with us the same man teaches both and we alternate one week operative and the other week prosthetic; four hours a day, two hours in the morning and two in the afternoon.

Dr. H. B. Tileston, Louisville College of Dental Surgery: The first three months the afternoons are devoted to prosthetic technics, four hours each afternoon, every afternoon of the week excepting Friday. The last three months, three afternoons in the week are devoted to prosthetic technics and three afternoons to operative technics, four hours each day. During the junior year the first six weeks are devoted exclusively in the afternoons to operative technics. Then for ten weeks following that the junior course is orthodontia technics. These technical instructions go hand in hand, of course, with didactic teaching in the same branch.

Dr. J. Q. Byram, Indiana Dental College: I have both the operative and prosthetic technics. I usually begin with the operative and run that for about three months and a half, fifteen hours a week. Then I take up the prosthetic and I finish the vulcanite prosthetic work the first year. In the junior year we do all our metal-plate technics, our shell crowns, porcelain crowns and all metal bridges, and our orthodontia technics. In the senior year we do our crown and bridge work. Some of the reasons for this Dr. Harper explained very nicely in the operative, but I think in considering these things you have got to take into consideration the individual school. Our freshmen get no lectures on metal plates or on crown and bridge work; consequently, in the junior year I try to teach the technic to follow the professors. When the professor lectures on the die and

counter-die each student must make a die and counter-die before the next lecture, and so on. The same is done in crown and bridge work. When the professor lectures on a certain crown the students must make that crown before the next lecture. With orthodontia it is the same way. When the professor of orthodontia gives a lecture and describes the making of a certain appliance, we try to follow it out, and we do all this work while it is fresh in the student's mind.

Dr. G. V. I. Brown: In closing this discussion I wish to thank you very much indeed. It is evident to me that this meeting has gone through very much the same mental process that I was obliged to go through myself when I undertook this work. I am very much gratified that it has arrived at a point where it is realized fully that there is something to be gotten out of a technic course of instruction. I think that if we begin upon some such foundation as this, beginning with the simple principles, then we will have practical technics, but the idea is that we have now the fundamental principles of what will ultimately be in all the colleges. If I can be instrumental in a small degree in bringing that about I shall be happy.

I would like to apologize to those that were to open the discussion, and express to them that I feel very much gratified that they undertook it. I had hoped to meet these gentlemen the first day and go over the matter with them, but that, unfortunately, was not allowable.

So far as the expressions of sympathy are concerned, that is the only thing about it that puzzles me. I find it difficult to dodge a brickbat and acknowledge a compliment at the same particular moment. However, I thank you all for its consideration; it has been very gratifying.

REPORT OF COMMITTEE ON SYLLABUS FOR A PROSTHETIC TECHNIC COURSE.

Your committee appointed last year to present an outline for a technical course presents herewith a schedule, designed to cover a possible technic course embracing plate, crown, bridge, regulating and instrument work.

It is designed to cover the entire field and made applicable to the longer-term schools. At the same time selections can be made from it, adapting it to the shorter-term schools or to a briefer course.

It is the design of the syllabus that the instruction shall be given as a demonstration before the entire class, and to this end the subjects have been so divided that one may be presented each hour. In some cases it may seem that one hour would not be sufficient to present the subject as outlined; but in these cases much of the manipulation has already been presented to the class and can be either omitted or done before coming into the classroom.

It is not intended that a lecture shall accompany the demonstration at the same hour, but at a different hour the lecturer on prosthetic art shall develop the application of the technical principles. It is desirable that the lecture course and technical instruction harmonize and be given concurrently, not necessarily by the same teacher, but preferably. Your committee has worked out the details for each hour, not the students' laboratory-work time, but each hour for its presentation by the teacher. We, however, find that it will take too long to read this and too much space to print, and have decided to present the subject headings only, in the following schedule, which we herewith present for your consideration.

Because of the necessary delays of registering and classifying students we have planned for the first week of the

course two preliminary lectures or talks. The first one you will note is intended to outline in a general way the object of the course and the ground to be covered by it, with suggestions as to helpful text-books or collateral readings.

The second hour we think can very wisely and profitably be spent in describing the tools which the student will have to use in the course, the value of a suitable and complete outfit, methods for taking care of them, the uses to which they will be put and warnings as to customary abuse of them, concluding with a statement as rules and regulations governing conduct in the laboratory. The third hour or the beginning of the second week the first demonstration will be given and the students put to work. Your committee follows here the general custom and begins with taking impressions, although we feel that for technics or manual training perhaps the course outlined for steel and instrument work would better serve as an introduction to a scientifically arranged technical course.

As an illustration of how each hour's work has been planned we will give the details of this first hour which is, taking impressions with beeswax.

Take impression in beeswax of the upper and lower dentures, using as a subject one of the students having an entire denture.

First—Prepare the patient, select and fit trays.

Second—Illustrate manipulation of material—methods of softening.

Third—Explain briefly reasons for its use.

Fourth—Illustrate introduction and removal from mouth.

Fifth—Criticise the impressions, call attention to probable errors and ways of overcoming them.

Sixth—Refer student to text-books or literature on the subject.

Seventh—Explain methods for overcoming frequent peculiarities, irregularities caused by extraction of teeth, etc.

Your committee has outlined each of the subjects enumerated below as illustrated in the above example, but because of its extent the entire outline can not be presented, and we would suggest that the most feasible way of presenting it to technic teachers will be to have perhaps one hundred copies printed and a copy placed in the hands of each teacher for criticism or test during the next session of our schools.

SCHEME OF PROSTHETIC TECHNIC.

To be Presented as a Class Demonstration Course.

PLATE TECHNIC.

First hour. Lecture—Describe course.

Second hour. Lecture—Describe tools, their care, use, etc.

Third hour. Demonstration—Impressions with beeswax.

Fourth hour. Demonstration—Mixing plaster, pouring and separating impressions.

Fifth hour. Lecture—Surface anatomy of mouth and teeth.

Sixth hour. Demonstration—Modeling compound impressions.

Seventh hour. Quiz—On anatomy of teeth, from students' models.

Eighth hour. Demonstration—Plaster impression.

Ninth hour. Lecture—The dental arches, occlusion of teeth, etc.

Tenth hour. Demonstration—Make upper vulcanite plate, one tooth.

Eleventh hour. Lecture—Vulcanizing and the vulcanizer.

Twelfth hour. Demonstration—Finish vulcanite plate, break and repair, remove tooth and replace.

Thirteenth hour. Demonstration—Secure models for partial upper and lowers, vulcanite plate, and articulate on Bonwill articulator.

Fourteenth hour. Demonstration—Grind teeth to articulation.

Fifteenth hour. Demonstration—Wax to contour, flask, pack and vulcanize.

Sixteenth hour. Demonstration—Finish plates, mount on models with wire articulator, for exhibition.

Seventeenth hour. Demonstration—Make full lower Watts metal base plate.

Eighteenth hour. Demonstration—With full upper models and Watts metal plate get "bite" by the Bonwill method.

Nineteenth hour. Lecture—Methods of obtaining "the bite" with accuracy and artistic results.

Twentieth and twenty-first hours. Demonstration—Grind to articulation full upper and lower set of teeth.

Twenty-second hour. Lecture—On materials used as "base plates," or gum section vs. plain teeth.

Twenty-third hour. Demonstration—Make dies for swaging full aluminum plate.

Twenty-fourth hour. Demonstration—Swage aluminum plate.

Twenty-fifth hour. Demonstration—Secure bite for full aluminum and partial lower cast metal; grind in plain teeth.

Twenty-sixth hour. Demonstration—Flask aluminum and attach teeth with red and pink vulcanite. Flask the lower in casting flask and cast plate to teeth.

Twenty-seventh hour. Demonstration—Finish both plates.

Twenty-eighth hour. Demonstration—Make dies for full upper and partial lower brass plates. Introduce Hawes flask and Babbit metal.

Twenty-ninth hour. Demonstration—Swage upper plate single, swage lower in two pieces which lap and solder.

Thirtieth hour. Lecture—Making and using solder.

Thirty-first hour. Demonstration—Prepare plates for attachment of teeth with vulcanite.

Thirty-second hour. Demonstration—Attach clasps or bands to lower plates, and back and solder two incisor teeth to plate.

Thirty-third hour. Demonstration—Finish plates and secure "the bite."

Thirty-fourth hour. Demonstration—Grind in teeth, flash and vulcanize.

Thirty-fifth hour. Demonstration—Polish plates with student facilities.

Thirty-sixth hour. Demonstration—Make small clasp saddle plate of silver, one or two teeth.

Thirty-seventh hour. Demonstration—Make celluloid plate.

Thirty-eighth hour. Demonstration—Make cast aluminum plate.

Thirty-ninth hour. Demonstration—Make continuous gum plate.

CROWN TECHNIC.

First hour. Lecture—Root preparation for various crowns.

Second hour. Demonstration—(a) Procure from prepared metal dummy articulated fusible alloy models. (b) Explain metals and alloys used.

Third hour. Demonstration—Shell crown, soldered, swaged cap.

Fourth hour. Demonstration—Shell crowns with solid cap.

Fifth hour. Demonstration—Seamless crowns.

Sixth hour. Demonstration—Porcelain-face seamless crowns.

Seventh hour. Demonstration—Lower incisor soldered shell crowns.

Eighth hour. Demonstration—Lower incisor, shell crown with post and porcelain face.

Ninth hour. Demonstration—Post and plate porcelain front crown.

Tenth hour. Demonstration—Post and plate porcelain front with root collar.

Eleventh hour. Demonstration—Post and plate porcelain front with lingual band.

Twelfth hour. Demonstration—Porcelain face bicuspid crown. Case Goslee, or Hollingsworth.

Thirteenth hour. Demonstration—Porcelain post, plate and collar crown, with low fusing, porcelain.

Fourteenth hour—Banding a Logan crown.

BRIDGE TECHNIC.

First hour. Lecture—Mechanical principles of construction.

Second and third hours. Demonstrations—Make bridge for lower bicuspid and molar with shell crown abutments.

Fourth and fifth hours. Demonstrations—Make lower incisor bridge, with one crib abutment, and the other a shell crown.

Sixth and seventh hours. Demonstrations—Make bridge for upper central incisor with lingual stay plates.

Eighth hour. Demonstration—Swing porcelain face dummy first bicuspid to shell crown on second bicuspid.

Ninth and tenth hours. Demonstrations—Make skeleton frame of German silver for porcelain bridge.

Eleventh and twelfth hours. Demonstrations—Make removable bridge for two bicuspids using cuspid and molar as abutments.

STEEL TECHNIC—PRELIMINARY LECTURE.

a. Nature of Steel, and Adaptation for Instruments. b. Methods of Manipulating.

First hour. Demonstration—Make a punch, from bar steel, forge and file.

Second hour. Demonstration—Point, temper and finish.

Third hour. Demonstration—Make tap for threading nuts.

Fourth hour. Demonstration—Make filing instrument for finishing nuts.

Fifth hour. Demonstration—Make straight gouge chisel.

Sixth hour. Demonstration—Make hatchet-shape excavator.

Seventh hour. Demonstration—Make a mallet plugger.

Eighth hour. Demonstration—Make serrating block.

Ninth hour. Demonstration — Make a double-ended wrench.

ORTHODONTIA TECHNIC.

First hour. Demonstration—Preparation of material for use.

Second hour. Demonstration—Make German-silver jack-screw.

Third hour. Demonstration—Adapt jack-screw to model with bands.

Fourth hour. Demonstration—Make case or angle reciprocal jack-screw.

Fifth hour. Demonstration—Make removable band.

Sixth hour. Demonstration—Make retaining band and bar.

Seventh hour. Demonstration—Make soldered band with eyelets, sockets and loops.

Eighth hour. Demonstration—Make piano-wire spring and attach by means of Jackson crib.

Ninth and tenth hours. Demonstrations—Make upper and lower Coffin-split plates.

Respectfully submitted,

N. S. HOFF,
G. H. WILSON,
H. J. GOSLEE,
Committee.

Dr. Grant Molyneaux of Cincinnati: I see very little in the paper to discuss at the present time. My opinion of the matter is that it ought to be published and studied for a year. This synopsis is new to me. It only fell into my hands within the last few minutes, and with the other duties of the day I haven't had a chance to consider it very much. But I think the best that can be made out of anything of this kind is as a suggestive measure. I do not believe it is possible for any three or more men to present a syllabus that we can follow positively, for a plan of teaching that would be successful in Dr. Hoff's hands might be a failure in my hands. I believe that the teaching of prosthetic dentistry should be based on a principle, whether in technical teaching or practical teaching at the chair. The pouring of a plaster model has its effect upon the adaptation of a plate, therefore the student should know the changes that take place in the pouring, hardening and crystallizing of plaster and the subsequent operations in constructing the plate. They are not mere mechanical details of showing how the flask is invested, vulcanized, etc., but all should be based on a principle. Has not our esteemed friend Dr. Snow presented four most admirable papers on the properties of vulcanite? They must all be considered in technical teaching, and that leads up to the various other steps in considering what the adaptation of a denture means. The student must be taught from the start that there are principles involved which either add to or

detract from the perfect adaptation of an artificial denture. As to prescribing the course of prosthetic technics, I would not do it, for the very reason that I may proceed on a certain course and I find that my methods are failing, and I must change that course in order to attract the attention of those students. I do not believe that anybody could prescribe a course of teaching that I could follow absolutely. We must adopt that course of training to the temperament of the students, and it seems to me that it would be ridiculous for us to make the teaching of any single method obligatory. That would be an absolute failure. As a suggestive measure I consider the report very good. As we look through the list we find in the eighteenth hour, "Demonstration—With full upper models and Watts metal plate get bite by the Bonwill method." Now I don't know what that means. In the nineteenth hour we find, "Methods of obtaining the bite with accuracy and artistic results." We find he makes dies for swaging an aluminum plate; then further on he makes dies for swaging a brass plate. Now zinc has been used as a die metal, but zinc was used by people who were mechanics and who knew how to compensate for its contraction. I would insist on the use of Babbit metal in every case. There is no use in teaching zinc. If we teach zinc we must teach the student how to measure the change that takes place. If we use a die metal it must be either zinc or Babbit metal. We cannot use the two and do any definite teaching. The Babbit metal gives us the nearest reproduction of the model, and if there is any attention to be given to the adaptation of a plate let it be made to the model, and Babbit metal will reproduce that more perfectly than any metal we have upon which we can swage plates. One other suggestion about this steel technic. You see a lot of lines here and instructions about making certain things. There isn't anything said about the sharpening of instruments. Dr. Black read a paper not long since giving

certain definite forms of cutting instruments. Now, if a man in the practice of dentistry who is teaching students certain principles takes an oil stone and goes over it and spoils the definite form of an instrument, that is his fault, he must not blame Dr. Black for that. The sharpening of an instrument is just as important as anything else, and there are definite methods by which an instrument can be sharpened, and there are definite methods for using an oil stone, and the forms as presented by Dr. Black can be maintained until that instrument is used to the shank. If you take an instrument with a right or left bevel and begin to rotate it all over a stone you will very soon not have the same instrument that was originally presented. There are a great many little things like that that go to make up the sum total of our mechanical technics. I don't care to teach a student how to make an instrument, except a few principles of technic. I can't teach a student to carve in ivory or soap. But I do think we are neglecting those things which maintain a system, and if Dr. Black has presented a system like he did last year of cutting instruments, then it behooves us to know how to maintain those forms.

Dr. H. B. Tileston of Louisville: This scheme of teaching as presented by Dr. Hoff gives us a base upon which we can formulate a course of prosthetic technics. While every teacher may not find it advisable to follow out accurately the plan laid down by Dr. Hoff, the points that he makes as those that we should pay special attention to are certainly very excellent. As Dr. Molyneaux says, it is something for us to think about. There isn't anything we can discuss, add to or detract from to-night. I have no doubt that we can improve upon it, however, by a year's study and bring this matter up again at some future time for further discussion. Dr. Hoff mentioned a point that is applicable to other branches of teaching as well as technic work, and that is the annoyance of having students coming

in after the work is begun, and the class of work that we should present first. I don't know that we ought to consider the absentees in arranging our course at all. But it is a great annoyance to have students coming in four or five days after the lectures have begun. I haven't anything to suggest as a remedy, except that the students ought to be there when the term opens, and we probably ought not to consider those who come in late. I haven't anything but commendation for Dr. Hoff's efforts in this direction. It will come up again later in the evening and then our teacher of prosthetic technics will probably have something to say of more practical value than anything I can present to you.

REPORT OF COMMITTEE ON SYLLABUS FOR OPERATIVE TECHNICS.

T. E. WEEKS, MINNEAPOLIS, CHAIRMAN.

Our report will be very brief. After a conference with the committee and much individual thought in the matter we have decided that this subject, like most others for teaching, may be divided into three parts—the what to teach, the when to teach and how to teach it—and your committee has decided to present only the first one of those parts; that is, what to teach, believing that if we can be fortunate enough to present an outline of what to teach that our society will accept, the when and the how will follow in natural sequence. If you cannot accept the what to teach there is no use to present the others at this time. Your committee would suggest that after a discussion of the six points that we have outlined on the chart, if you agree upon those, that this committee or another to succeed it be empowered to provide syllabi under each heading, syllabi which could be followed in teaching. We recognize

the fact that no teacher can sink his individuality sufficiently to accept anything that any man may prescribe for him, unaltered, and your committee has agreed that in the presenting of these syllabi it would be necessary to present syllabi of a somewhat flexible nature. In the carving of teeth one man believes that better results may be arrived at by making a definite system of measurements; another thinks he can arrive at good results by imitating the natural teeth irrespective of measurement. As it was somewhat of an extensive job we decided to present only the six, then if you are pleased with those and if you desire we will go on, or you can appoint another committee to go on and prepare other syllabi under those heads. We have endeavored to select those subjects as indicated in the various catalogues and from the exhibits that we felt might meet with the approval of at least the majority. And in the working out of detail with the subjects that I have mentioned I think that syllabi might be prepared that might be acceptable to all by recognizing the existing differences that do exist because of the individuality of teachers and because of conditions, environments, etc.

The following chart contains the syllabus:

CHART.

1. Nomenclature.

2. Dental anatomy: (a) Study of external tooth forms; carving in natural sizes and form. (b) Macroscopic anatomy; cutting and describing longitudinal and transverse sections of natural teeth.

3. Instrument nomenclature; making models of instruments.

4. Cavity preparation and instrumentation: (a) Manipulation, grasps, rests, direction and control of force. (b) Sharpening instruments. (c) Forming cavities by measure-

ment. (d) Preparing classified cavities with their instrumentation.

5. Cleansing and filling of root canals.

6. Filling materials; their preparation and manipulation.

Dr. L. S. Tenev, of Chicago: From the manner in which the subject has been presented I don't know that any lengthy discussion is called for, and I shall not attempt anything more than one or two general observations. As I viewed the exhibits to-day and listened to the discussion I could not but remark the great progress that has been made in operative technics, for this is the work in which I have been specially interested since its inauguration some ten or eleven years ago. While the work at that time was vastly ahead of anything that had previously been attempted of a similar character, it was crude and primitive as compared with the more advanced methods of to-day. Indeed it seems that the spirit of progress that has pervaded the dental profession and our colleges and so enlarged the scope of college training has been especially active in this technic work, for the reason, I presume, that we have found here an almost uncultivated field for our efforts. Now in the evolution that has taken place we observe that the tendency has been to eliminate those features of the work requiring the least thought and the least manipulative ability. I have in mind particularly the extensive tooth dissecting that we indulged in formerly, and still do to a certain extent, but where we spent five or six weeks at it a few years ago we now spend about as many days, and the tendency has been to introduce methods and exercises calling for more thought and a higher degree of skill. And it seems to me that this should be the constant effort, to train the mind and the hand to work together, for the most thorough knowledge of the underlying principles is of no value without the skill to apply them. And, on the other hand,

a high degree of skill will avail little without the guidance of a well trained mind and a sound judgment. One thing that has troubled me somewhat in this work has been the question of time, for with the broadening out of the field of dental technics and the addition of features from time to time, I find the time that I have at my disposal lessening and it would seem impossible to add anything more without crowding something more valuable out. In fact, I have advocated a course of junior technics extending over a course of two years instead of one. It may be that the solution of this problem would be found in a lengthening of the entire course. This year I introduced a little instrument technic, making instruments in brass, the idea being not for the knowledge of instrument making, but rather for the purpose of teaching the existing instrument nomenclature as outlined by Dr. Black. The results of that work you have probably observed in the exhibits. Another thing that I want to call your attention to are the models which perhaps most of you have seen in the exhibits. These models have been of valuable assistance to me in this work and they seem to be ideal teaching models. In fact, having used them through one session, I can hardly realize how I have ever conveyed a knowledge of dental anatomy without the use of these teaching models. They are light and portable and easily handled. They are large enough to show the form of the tooth and the surface characteristics, and at the same time not so large as to be cumbersome. The course as outlined by Dr. Weeks, while no radical departures have been made, is certainly to be commended, and it is the course that we have followed practically for a number of years.

At this point the discussion of the two reports was merged into one.

Dr. R. R. Freeman of Nashville: This is the first time that I have ever had the opportunity to be present in person

at the meeting of this association, although we have had representatives present who are able to bear your spirit into our section and they have impressed upon my mind the work that you have been engaged in. I have been in full sympathy with the work and have been very greatly helped by the work that you have done. The first subject that was presented in the syllabus of prosthetic technics impressed me immediately as being of such value that I feel fully compensated for any inconvenience in the way of a trip, regardless of the social intercourse with my brothers in being here on this occasion. Our educational standard presumes that students will have been taught how to think, that is the object of education, and when they come qualified to think what we have to do is to present subjects for their reflection, and by this means which we have worked ou in the fullness of our brains we make an easy inroad to their minds and they comprehend readily. The demonstrators, whose business it is to present these matters to the students, have come in contact with these knowing brains, and, as a matter of fact, they must go home and be prepared to teach. To say that this would be of no value and avail nothing because of my peculiar methods of teaching—why that is preposterous. No matter what had been my methods, if those methods have been accomplishing results by which I was able to make dentists, this would give me thought by which I could shorten those methods and reach points with more facility than I have been able to reach them before. The doctor remarked to me the other day, "We want to see what we can get out of you before we know whether or not you are very enthusiastic on this line." It is not a question of what you are going to get out of me. I came here to get something out of you and I have got it. I want a copy of the syllabus, because the very indication presented in this synopsis indicate that this syllabus is just the thing I want. I won't have to sift around because there is not going to be any chaff

there. It is the evolution of this society for the last ten years brought down here. It is just food ready for our digestion, all we have got to do is to takė it in. Therefore, I want to commend the committee and I want to say that it is an inspiration to me and it will be to anyone who listens to it.

Dr. G. H. Wilson, Cleveland: I have nothing to say on operative technics, but feel that we should get down to the prosthetic technics first. I believe that we have a good foundation. It is certainly not expected that you will follow the plan set forth precisely. I was on the committee to formulate this syllabus. It is the work of only three men, and yet there are thoughts there that will help us all. If we have formulated this one thought I think we have done well, and that is that technic work is not clinical work, that it is working the material and preparing it to do other work. If we have made this clear and distinct I think that we have succeeded very well indeed. And I do not see why it should not be clear, because the patient is not interested in this at all. It is simply the what to do and how to do it, with the reasons why, showing that it is something separate and distinct from the chair of prosthesis. The professor that lectures on the subject teaches the art, and so on, and this is simply to prepare the way for the intelligent comprehension of this teaching. I do think that we can continue a little farther than has been done. For instance, the artistic side of it. We can continue that without stopping to explain why. We simply say do this and do that, and when the professor of that department takes it up he makes it all clear. But as a foundation I believe it is something that all can profit by, and I know that there are schools in our association, and some not in the association, that have not a proper conception of what prosthetic technics means, and when this is prepared I believe it will be a foundation to help just that class.

Dr. H. J. Goslee of Chicago: As a member of the committee whose pleasure it was to draft this syllabus of prosthetic technics it would not be expected of me, of course, to commend the work, but I do want to say, especially to those of you who have not made an effort to do anything in this line, that while we know it is not at all complete, it represents a great deal of labor for all three members of the committee, and more especially for the chairman, who has taken the combined efforts of all, the composite, and fitted them together in good shape and form for presentation. As Dr. Wilson has said, I don't believe it would be possible for all of us to agree to the proposition presented, but as has been stated by Dr. Freeman, we have all profited by the presentation of it whether we all agree with it or not, for the reason that it offers food for thought. Now my idea in the presentation of a syllabus of prosthetic technics was that we should deal with principles as well as methods. None of us can study and get up a system of teaching methods without first having something to do with and something to say about the principles underlying those methods. My idea also was that we should not alone designate the hours prescribed for this work, but also put it into the years; i. e., designate it in the first, second or third year, whichever may be the pleasure of the society.

There isn't anything in particular that I wish to criticise in this syllabus with the possible exception of the work in orthodontia. I believe that in the technic of orthodontia we really ought to begin with the fundamental principles underlying that subject, and certainly that relates to the application of force. Now that is not mechanical, it is physical, of course. We should begin first then, I believe, with the study of physics. Then the student begins to construct mechanical appliances for the correction of irregularities of the teeth. They know what principles they are working under; they know exactly what they are doing,

what they are endeavoring to accomplish. I believe, gentlemen, that if this committee, or one which you may see fit, perhaps, to appoint, would give another year's effort they would present something in the aggregate that would be of much more benefit and advantage than even this has been, and yet, I feel that this is all that any of us could expect. I believe that we do not have quite enough time in which to teach prosthetic technics, for the reason that we endeavor, most of us I believe, to teach the two, operative and prosthetic technics, hand in hand. I think that we should begin with the fundamental part of it and teach that through the first year and possibly a portion of the second, and then take up operative technics. I know, so far as I myself am concerned, that it would be a big advantage if operative technics followed prosthetic technics.

Dr. E. C. Kirk of Philadelphia: I came here with the hope and expectation of learning something, and I have learned so much that I am in a sort of mental confusion on one or two features that have been raised here this evening. I am questioning in my own mind if we are not letting this technic idea run riot. I understand that what is presented here is intended to be taught by an adjunct to the chair of prosthetic dentistry; that is to say, the work of technic teaching is to be done by a sub-instructor. If that be true then, I want to know what is left for the professor of prosthetic dentistry. In other words, I want to make a plea for the didactic side of this subject. It has not been defined, or at least I have not had it clearly defined as to what ground this lecture course which is to be given by the adjunct teacher is to cover, just how far he is going. Now, the essence of technic teaching, it seems to me, is that it is a method of appealing to a man's intellect through the medium of his preceptive powers; it superadds the appeal which is made through his tactile sense. Two things ought to be gotten out of the technic system as applied to the art

of dentistry; first, a mental grasp of the things being done, and a muscular training in the ability to do it. Now I would like to see something left for the didactic teacher to do and the elaboration of this manual training idea in the didactic method; that is, the appeal to other senses than the sense of hearing, and I should be very glad if those who are responsible for this matter, or those who know more about it than I do, would indicate some line of demarcation as between the didactic phase of this subject, that portion which is to be done didactically and that which is to be done in the laboratory. It seems to me that in our desire to emphasize the technic system we are minimizing the great importance of didactic instruction. They must go together; they must harmonize with one anoher.

Dr. G. H. Wilson of Cleveland: Technic teaching should embrace what to do and how to do it; to the didactic teacher belongs the philosophy of the discussion of methods. We have certain materials to use in the technic work. We have no time to stop to discuss those materials. The didactic teacher must discuss those. The teacher of technic cannot go into the history of vulcanite, the didactic teacher must. The technic teacher cannot discuss the composition of vulcanite, the didactic teacher must. The didatic teacher must discuss and point out his idea of the preferable method of technic, giving simply one method.

Dr. H. J. Goslee: I would like to ask Dr. Wilson if he does not think that in the teaching of the use of materials, for instance, their advantages and disadvantages should be taught.

Dr. Wilson: That belongs to the didactic teacher.

Dr. H. A. Smith, Cincinnati: I would like to say in regard to this syllabus that it is only suggestive. I think it impracticable for two men to agree to carry out the same

scheme in this department, but in the main it is very valuable, I think. Under the head of prosthetic technic we have "crown technic." I simply wanted to ask the question if it is proper to delegate crown technic, or the practice of the insertion of crowns to this department. Does it not properly belong to the operative department?

Dr. N. S. Hoff: The American Dental Association recorded it under the head of prosthetic dentistry.

Dr. H. A. Smith: They are not always right. It says the preparation of roots. Of course that means the preparation of the root of a tooth out of the mouth.

Dr. Hoff: Certainly.

Dr. Smith: The student would have a dental engine perhaps.

Dr. Hoff: No; the work is all done with hand instruments.

Dr. Smith: But just as soon as he learns this in the laboratory he is then an operative dentist when he proceeds with this work.

Dr. J. P. Gray, Nashville: I want to commend the report very highly. I think it is a good thing. I think, as others, that it is only suggestive in many things, but it gives us all something to go by. We form a lecture card to lecture from in the didactic department, and this is simply taking the place of that in the technic department. Now I do not believe in taking up the steel technic and making many instruments; I think that is largely a waste of time. However, others think differently. But when we come to crown and bridge work I think that is as much a part of technic and a part of prosthetic dentistry as any other part. You might call the putting in of a plate operative dentistry, so far as that is concerned; you are simply restoring lost tissue the same as you do in the tooth and you can't separate

them. So while there is no line of demarcation between the two, taking it altogether, prosthetic dentistry simply means operative dentistry. So I think that this properly belongs in this part of the work, and it should be pushed along as fast as possible. This committee ought to be continued because they have the work well in hand and can take it up and give us something next year that will be more valuable. They will possibly eliminate some things that they have in it now and add others.

Dr. J. Q. Byram of Indianapolis: From the remarks that have been made one would be led to infer that most of us are prosthetic teachers. There has been very little said from the operative standpoint. Teaching both, I feel that there is something in operative dentistry. Now just where to draw the line between the teacher of technic and the professor of the subject is a hard question. It is true that the teacher of technic ought to follow out the instruction given by the professor of that chair, in either operative or prosthetic; but still, I don't care to go before my class unless I can tell them what I want them to do. I want to go farther, I want to explain why; I want to go into the whys and wherefores. I find that when our professor of operative dentistry lectures, and I go over the same thing in my dental anatomy technic, that there are points which the students get that they had forgotten from the lecture. And I find the same thing in prosthetic technics. I like to follow the professors and go over their work, of course, not so thoroughly as they do, but it freshens the student's memory and he is much more able to grasp the subject than he is if I simply tell him what to do and how to do it.

Now in regard to Dr. Weeks' work. I commend it very highly. I will say that I have gotten more good points from Dr. Weeks on operative technics than anyone else. I follow his course almost to the letter, and I find that everything he has said can be commended highly.

Dr. O. A. Weise of Minneapolis: I would give my testimony in behalf of the report presented by Dr. Hoff. There has been considerable controversy here this evening in regard to whether principles should be taught hand in hand with purely technical work. The short time that I have been a teacher it has seemed to me that students generally are only capable of doing a certain amount in a given time, and if we can confine our work to purely technic work it always seems to me that we make better progress than when we reach out into the didactic work and go into all the various principles that are involved in doing technic work. Let the didactic work come after. They have their eyes opened, they see what they are doing and they are able to apply a great deal for themselves, and when the didactic work comes they are able to grasp it a great deal more readily.

Dr. A. F. Webster of Toronto, Ontario: I don't know that I have anything to say, any more than I am probably in the same position as one of the other gentlemen; that is, we have a professor of technic who gives the lectures in the didactic course. The object of my position is to demonstrate what he has lectured upon. I find it very hard to just keep in touch with the lectures, and just as soon as I find that a subject has been covered by the professor I drop it at once and leave the explanation of that with the students. But where I find that it has not yet been reached in the course and probably will not be covered, then I must say something about it. For instance, we talk about using disinfectants in the treating of a root-canal. If the students have not had anything at all on materia medica it is not very good sense to go on and talk about disinfectants and your students not know what you are talking about. That is an illustration of the trouble of keeping in line with the professor of the subject, and all other subjects have to be conducted in that way.

Dr. J. D. Patterson of Kansas City: I do not rise to discuss the report of the committees on these syllabi, but there is one thing which seems to me important in plate technic which has not been mentioned. In the third hour in plate technic Dr. Hoff begins with impressions. Impressions of what? In our laboratory we have one or two darkeys whom we pay $1 a day, and the student can take as many impressions as he pleases. I want to suggest that one of the most important things in making plates is entirely omitted there, and I would suggest that it be added. We all know that nine out of ten mouths have hard and soft territories, and there is no provision whatever for making reciprocal pressure in this technic course. It is a very important point to trim your model so that the plate will rest with reciprocal pressure upon the hard and soft parts. It is one of the first basal principles of a satisfactory plate and it is entirely omitted here.

Dr. Hoff: How do you get that reciprocal pressure?

Dr. Patterson: Is it possible that you do not know? There is no method whatever outlined here.

Dr. Hoff: That is not our business.

Dr. Patterson: I beg your pardon. Your business is to make a plate in a proper manner. How do you arrange the teeth; do you arrange them any way? You want your plate to rest in the mouth in a way that will be satisfactory. Why don't you put this down here? And I would change about the third hour and take the fifth hour instead of the third. In addition to dental anatomy teaching I would go over the surface anatomy of the mouth and teeth which you have in the fifth hour. This surely should be gone over before you permit a student to take an impression. I am down on the program to-morrow and will not say what I intended to say further until that time.

Dr. N. S. Hoff: Some of the speakers think we are getting away from technics, or away from the object of this organization. In fact this is a purely technical method of teaching. But the discussion indicates clearly the necessity for discussing both pedagogics and technics. Some one wants to know what the lecturer on prosthetic dentistry has to do, thinking we have dropped him altogether. If I could take you into my confidence and tell you what I think about it I would say that by this technic scheme we have given material for the lecture course on prosthetic dentistry, comprising more work than any of us ever thought of doing. There are more principles to be discussed. It is not the intention to discuss these principles or bring them into the technic teaching at all, except where it is necessary to explain the process, and then only by very brief reference. The ideal manner of presenting this subject is that this technic course shall be presented, not necessarily by the demonstrators but preferably by the professor of prosthetic dentistry as a demonstration before the class, but not as a lecture, to illustrate the lecture which should be given at another hour. There is material in this syllabus to make a course of lectures of from fifty to one hundred hours, and if that is not enough work to satisfy Dr. Moylneaux it certainly would be enough to satisfy me. I don't believe that the principles involved in that syllabus as we presented it can be adequately considered in one hundred hours of lectures.

A Member: Why did you give so much, Doctor?

Dr. Hoff: Simply because we wanted to give you a selection. We have tried to embrace the entire subject. If you will carefully study that syllabus I think you will find that everything is covered. Dr. Patterson says that we haven't covered the point of providing for reciprocal pressure. That question can not be taught technically as well as didactically.

Dr. T. E. Weeks: I think I have said all that I have to say, as there was practically no discussion. We attempted to present this matter in such a way that it could be received, rejected or modified. I should decide from the failure of anyone to criticise it that it might possibly be accepted. And you will remember that it was the recommendation of the committee that if the list of points to be covered in the presentation of operative technics was satisfactory to the society, that a syllabus detailing methods under each of those heads be prepared.

CONDUCT OF THE OPERATORY.

(Operative Clinic.)

W. H. WHITSLAR, M. D., D. D. S., CLEVELAND.

To conduct an operatory requires science and productive art; science, because of a necessity for a systematic and orderly arrangement of knowledge, and art, which contemplates methods for the application of this knowledge.

Science is concerned with higher truths, art with the lower. Science invariably increases the interest and varieties of life, and reveals exquisite possibilities. For this purpose, artful methods of inducing results constitutes almost a science of itself.

The technicals of dentistry bear the same relation to the science, as a good dictionary bears to literature. Technical instruction is surely one of the royal roads to learning. Technism, then, of the operatory, requires of its teacher, that he possess accurate knowledge of the work to be accomplished and the capabilities of an artisan. He should know everything of something and something of everything. To simplify this knowledge evinces great wisdom. The instruction we seek to impart must be progressive, commencing with the A B C of the science. Passing from the earlier

essentials of education, we learn from the nature of the young that too much concentration on any one subject is a mistake; therefore, the grandest opportunities exist in the diversity of instruction when the student reaches the operatory. It is technism animated. With life principles incorporated into the realm of consideration, it accustoms students to trace sequences of cause and effect; it quickens and cultivates the faculty of observation, which in some persons is dormant until aroused. Operating upon living tissues induces a reasoning which corrects indolence, and it is not purely an effort of the memory. Straining the memory is not cultivation of the mind; therefore we do not desire to exact fixed sentences as definitions, but rather to elicit the principle or spirit of the understanding.

One of the first ideas that we seek to impress upon students entering the operatory is the vastness of the knowledge to be unfolded to them, and that whilst it is our purpose to guide them, yet we are together seeking for wisdom. It is no part of wisdom to insinuate that we know everything; but impress the student that we are affiliated in one grand purpose. If we do this, we teach him to thirst for knowledge, and he will soon teach himself more than he ever thought possible. He will be observant, and, being so, naturally questions will arise in his mind. Encourage questions, for a prudent question is one-half of wisdom. If this principle of natural inquiry be induced in student life, his education will continue throughout his career. Thus we teach industry and beget reason.

"Industry must be our oracle and reason our Apollo."

The pinnacle of technical teaching in the dental college is reached when the student enters the clinical department. This is the plane where the future dentist attains a closer affinity to the realm of practice, and the ragged surfaces are polished not only of his mechanical ability, but of his mind. He now observes more clearly his duty to humanity, which

constitutes dental ethics. The whole college is like a machine, the student is the material out of which the college, or machine, is to elaborate a finished product, the dentist. The student is taken into the laboratory and is pulled, twisted, hammered, and rolled, into better texture, and finally his ideas and accomplishments are molded into various accessories. Then comes the time when all those habiliments are necessary, and we find a finishing room to assemble all of the parts. In accordance with the perfect workmanship of the various departments of the college will we find the parts correlated, and unless there is a flaw in the material we may expect reasonable perfection.

Now the operatory may be likened to the finishing room. Here the flaws are discovered and cast out, or the parts are assembled and conjointly all parts are put into action. Every part of the new-born mechanism is ready for a definite purpose. Herein is where the physical and mental systems are subjugated and brought to a realization that the finest expressions of nervous energy are required to attain proficiency in the art and science of dentistry.

It requires technical skill to train students to utilize their knowledge and powers and it can not be urged too strongly to first simplify, then expand, methods. The accomplishment of these ideas can not be acquired by having irregular instructors, but the attention must be constant and personal. An instructor who is just commencing to impart information will very often try to pursue unique or difficult methods, or, the undergraduate who is insufficiently educated to demonstrate principles. Both are incapable teachers.

Clinics by famous operators are valuable adjuncts to a college, as they illustrate the man and his methods, but lasting and most beneficial results follow the persistent direction of the experienced teacher.

It has not been long since that the operative clinic was open to all students, and it may be so in some of the col-

leges to-day; if so, clinical material is used indiscriminately, and direful results must follow through ignorance. The principle is all wrong to admit freshman students to operate before a proper attention is given to the technicals of dentistry.

There is yet a chasm between the technic room and the operatory. Those of experience regard many things simple with which they are familiar, but which to a student are difficult. In some clinics we are informed that students are told to "go to work." This is a travesty upon our system of education. After the completion of the operative technic course, preliminary instruction should be given by way of demonstrations and lectures in the classroom before the student enters the operatory, so that he will not be uncouth.

This preliminary instruction should embrace the following items:

1. Appreciation of the value of the teeth and operations thereon.
2. The operator; his health, and care of his clothes and hands.
3. Deportment and reception of patients.
4. Dental chairs, their mechanism. How to adjust chairs for patient and operator.
5. Instruments of common use, engine, rubber cloth, clamps, forceps, etc., and their care, as well as the care of operating instruments; sterilization.
6. Examinations and records.
7. Preparation of materials for filling teeth.
8. Classes of operations.

All of the subjects should be elaborated even at the risk of having been previously taught. With all this instruction we find sometimes bright students in the actual technic course failing to apply their knowledge technically to living tissues. He must now apply his knowledge of anat-

omy, physiology, and chemistry, as well as the physical forces.

Fear is the principal agent which wrecks for a time the correlation of students' ideas and the promulgation of former instruction.

The study of human nature, its idiosyncrasies, and a knowledge of the student's preparation for the work, together with the many other items, enter into the problem of forming, in his career, stability of habits and ideas which in a measure are influenced by his confidence in his preceptor. Sympathy enables the teacher to attain wonderful results with students.

To produce these results, it is necessary in the first place to provide clinical material suitable to the purpose. Here great care and tact are required. The examination and assignment of cases to each student also requires a knowledge of the needs of the student in order to make his study progressive; otherwise he blindly stumbles in the pathway of knowledge. Art fails if he has an assignment which is far beyond his capabilities. Limitations also of the number of operations he can perform is a detriment to the student and college.

Outside of the ordinary operations for filling teeth, one of the most entrancing subjects is the study of the diseases of the teeth and mouth. This presents the greatest diversity. Graduates are regretful that they did not spend more time in such observations. It is a great pleasure to attract their attention to the conditions, which, if done catechetically, induces the reasoning powers of the students. This is the most gratifying study in this department, for the whole economy is therein involved. In fact, there is no department of science in the dental college that involves so much technical application of general knowledge as the operative clinic.

The sum of the previous years of instruction may here be concentrated. Hence we urge that in our various colleges the very best men should be selected for the performance of the care of the operatory.

Business details of the clinic involves the question of fees for infirmary service and their relation to the profession at large. This is one of the most difficult problems we have to solve. Duty to the students for clinical material, duty to them when they graduate and practice in the same neighborhood, duty to the older practitioners, presents three sides to the question. Denying these privileges to patients sometimes solves the problem, at other times the apparent necessity for free service also settles the inquiry. English colleges, I believe, are freed from such intricacies.

Every college has its methods of keeping records of operations, attendance, examinations, etc., and it seems to me that an exhibition of such procedures would come within the province of this association, and we trust that such an exhibit can be formed at the next meeting.

In concluding, let me urge again that in the conduct of the operatory we utilize simple methods, induce observation and reasoning powers, and teach students to use them. Bacon states: "Crafty men condemn studies, simple men admire them, and wise men use them."

THE PROBLEM OF METHODS.

C. M. WRIGHT, D. D. S., CINCINNATI, O.

At this symposium, where philosophers sit at an imaginary banquet and discuss "Methods of Teaching," we feel that while we possess cultivated appetites for a great variety of epicurean delicacies, and can fully appreciate all the viands of the most elaborate and perfect menu, we are condemned to partake of one special dish at this particular

feast. We are confronted with the question, "How can we best teach our special art?" We, like the teachers of law or theology, medicine or music, literature or art, are always turning over in our minds special propositions, such as "The old way of teaching by lectures is superior to the new laboratory method."

"The recitative has superseded the lecture system."

"The didactic has good points, so has the laboratory plan; mix or combine them."

Everybody who has been placed in the position of a teacher has thought about methods, but definite notions are rare. The subject is complex and as difficult as any that appeals to the judgment of intelligent men.

To clearly define the relationship of man to the conditions surrounding him has been, since the dawn of mind, the worthy object of the most earnest thought of many philosophers and students. Definite methods of arranging some plan of reasonable relationship have been faithfully sought as one of the highest aims of philosophy.

The history of the subject seems to point to the fact that methods of education are outgrowths of circumstances, and are subject to the same law of evolution which is believed to prevail in religion, politics and society. Environment causes the question of methods to shift, with the shifting circumstances of progress. Persistent conservatism has shown itself as a restraining influence, makinr radical changes rare in certain phases of educational methods, as, for example, in the position of Greek and Latin as essentials to a "liberal" education.

Our little fragment of the immense subject is just as difficult of adjustment as any other, because it is so intimately linked with the whole, and because, if we could establish a law of method for the atom, it would apply to the mass. The apple falling to the ground obeys the same law that governs the entire system of celestial bodies. Let us then be content at this feast to discuss our apple.

While reading the paper from Dr. Black, in "The Proceedings of this Society for the Year 1897," in which the height of scientific classification of the instruments used by dentists seems to have been obtained, I called to mind a remark made on one occasion by an old partner of mine—"Wright, I have lost my plugger, and I can't fill teeth without it."

This esteemed friend was peculiarly skillful in all the various manipulations of gold and silver plate and solders. In the so-called operative department he yearly filled thousands of teeth with gold ropes slightly annealed, requiring less space between the teeth, less time for the operation, with less fear of moisture (seldom using a napkin or bibulous paper, and never the rubber cloth), than any operator that I ever knew. He used very few cutting instruments, and but one plugger, and was wonderfully dexterous. The proportion of successful operations from his hands would, I think, compare favorably with those from the hands of high-class dentists of his day.

The picture of this gentleman, while engaged at the chair or in his laboratory, was one of applied technical ability, deftness, and a power to do that, though apparently automatic, implied infinite practice in the acquiring of this harmonious muscular response to nervous impulse.

The picture of the modern, well-trained college graduate, at his chair or in his laboratory, is embellished with wonderfully well-devised instruments, and our attention is perhaps diverted from the picture itself to the elaborate frame in which it is set—from the juggler to the knives and glass balls with which he performs his tricks.

The question has arisen among old teachers in modern colleges and academies, "Are modern methods too mechanical in kind to accomplish the highest results in the true education of the student?" It is possible to devote

attention to the elaborate method of teaching and forget the object of all education.

A distinguished professor in our Cincinnati Law School said to me: "A boy must learn law by our 'Harvard method' or drop out of the school. By the old method, anybody could pass." I asked the Judge: "But may not the boy that is dropped out of your class become a great lawyer?" Great lawyers, like great preachers, great scientists, great generals, and great financiers, have often sprung from the most unpromising and least expected sources. Masters in every position in which human endeavor has distinguished itself have appeared before the world with no systematic and labored school preparation for the niche which seemed to be waiting for their occupancy.

Our methods of education are not arranged for the masters only, but for the army of apprentices, the privates, the many. The modern methods of teaching in schools and colleges is a natural growth for, and on account of, the public—a demand of the times in which we live; a demand for ready-made goods in large quantity, and all of nearly the same pattern. We, of the older regime, push along the crowd of eager teachers, who are conscientiously and earnestly engaged in the study and adaptation of methods suitable to these stirring times of electricity and machinery. We recognize clearly, but with a certain—shall I say "old fogy"—regret that the ways of our college days have passed into history. The dear old doctor who taught us moral and mental philosophy and laid the foundations of character, on the rock of reason, based on the general principles of Christianity and gentlemanly conduct, could not to-day hold the chair of ethics in any college, unless he, too, had moved with the crowd, and would introduce into his classroom charts and blackboards, levers and compasses, while talking to the modern student about mind and morals.

It is the tendency of the times to be mechanical and exact, to try to measure our moral perceptions with an instrument—to locate the nerve center engaged in every thought. History and law, as well as chemistry and physiology, must be taught by laboratory methods. Our schools are like the systems of military organizations in Germany and Russia. The recruits must be made by a careful system into automata, and every muscle of every individual must be trained to move simultaneously. We admire the result as shown in the maneuvers of the regiment on parade, and admit that the whole is a thing of beauty. No one would, however, speak of one of our regiments of volunteer infantry, and sharpshooters, and rough riders, as an automaton. Here we see a lot of individuals. Each one is distinct and different in action and expression, and yet American volunteers make intelligent soldiers and successful fighters.

In the training of soldiers we have schools for officers and drills for the men. A different method of instruction, if you please, for the rank and for the file. In the arts we have superior and inferior workmen. The designer and sculptor, and the workman and stonemason. In manufactories we have masters and apprentices.

A different method is pursued in the education of the master from that which would make the best apprentice and workman. We, in our special branch of art and science, need—and in our dental colleges we propose to make—accomplished mechanics as well as professional men. Are we too ambitious, and have we the methods suitable to each?

In the past, demonstrations even of purely mechanical contrivances, were made to classes in the lecture room, and principles of practice, theories in etiology and physiology, and doctrines of pathology, were presented by lecturers to a heterogeneous company of boys and men, who came from —anywhere. The technical training departments occupied

a minor position, and the laboratory and infirmary were often rooms where the students could congregate to talk and smoke and wrestle between lectures. And yet many of the old graduates made good soldiers and fighters, and became masters in their profession. This, as President Eliot, of Harvard, says about the medical profession, "speaks volumes for the educating force of practice; that out of such raw material there could be produced, in the course of years, so fair a proportion of skillful, humane and successful practitioners. We have here," he says, "a demonstration that medical study, contrary to the too common opinion, is, to a man of ordinary intelligence and conscientiousness, refining, developing and uplifting. These excellent influences, however, it is the province of a well-conceived systematic education to provide in youth, before practice begins."

This "educating force of practice" is a conspicuous fact in the lives and work of many of our most esteemed professional confreres. But, do we not, in an especial degree, need the training in technique—like the musician and artist.

A distinguished writer, in comparing modern with early music, has said: "Along with certain advance, there is a perceptible falling off in symmetry and completeness of design, and in what I would call spontaneousness of composition in modern music." He goes on to say that he believes this is "because modern composers, as a rule, do not drudge patiently enough upon counterpoint. They do not get the absolute mastery over technical difficulties of figuration, which was the great secret of the incredible facility and spontaneity of compositions displayed by Handel and Bach.

"A similar illustration might be drawn from the history of modern painting, that, however noble the conception of the great painters of the present century, there is none who

has gained so complete a mastery over the technicalities of drawing and the handling of the brush as was required in the time of Raphael, Titian or Rubens."

Perhaps the Bachs and Raphaels of our profession acquired their mastery over the technicalities of plate-making and gold fillings in the shops of silversmiths and jewelers, and brought trained fingers with them when they entered the dental field; but, however their deftness may have been acquired, this deftness which has given the American dentist his supremacy in all countries of the world, we must recognize the importance of such mastery in technicalities. The name and object of this School of Teachers, whom I have the honor of addressing to-day, gives assent to this statement. We are seeking methods of education in technics.

Descartes was studying the problem of methods two hundred years ago as assiduously as we are now, in 1898. He said in 1648: "The end of all study ought to be to guide the mind to form true and sound judgments on everything that may be presented to it. The mind is not for the sake of knowledge, but knowledge for the sake of mind. Knowledge, if it is to have any value, must be intelligence and not erudition."

In our day, President Eliot says: "A considerable change in the methods of education has been determined during the past twenty-five years by the general recognition of the principle that effective power in action is the true end of education. The main object of education nowadays is to give the pupil power of doing himself an endless variety of things, which, uneducated, he could not do."

In reference to medical education, he says: "To give personal power in action under responsibility is the prime object of all medical education." Is this not pre-eminently true in the education of dentists? And our laboratories and various special departments for elementary training

and practical work have become a pronounced and conspicuous feature of the modern dental college—an utterly unknown condition a quarter of a century ago. The dental college of to-day is something like a school of instruction in a factory, or like a special school of technology. Every student has a bench and a "chair" at which he works, at stated hours every day, under the eye of a superintendent, and he is expected to acquire a high degree of mechanical or technical skill before he may be graduated. This, with his study of the principles of medical theory, occupies his thoughts and efforts during his college course. It is a common saying among professors that a graduate from a dental college, beginning practice to-day, is "splendidly equipped for his work." Does this not mean that he is educated in the sense in which Descartes and Eliot use the term? Does it not mean that he has laid the foundation for thought, for sound judgment, for future development of his power to do the right thing under responsibility, in the position in which he has elected to be placed?

What does the public care for an erudite mind in its dentist, if he has not this power to act under responsibility? Erudition is an accomplishment; it is like a sweet breath, or well-manicured nails, or neat attire, making one agreeable to his patients, but useless without finger-craft, guided by judgment and intelligence.

And now, gentlemen, to what does all this study of pros and cons, in regard to the value of present or past methods and opinions, lead? Can we solve our problem? Can we arrive at conclusions suitable for present-day demands, with possibilities of future progress in the education of dentists?

Mr. John S. Billings of Washington, in an address to the alumni of Miami University, on "Waste Products of Human Life," drew the picture of a young man in a college dormitory who bought a two-dollar fiddle and a thirty-cent

bow, and who at midnight used to scrape the cat-gut to the tune of "Nearer, My God, to Thee," till every occupant of every other room in the building sincerely prayed that God might take that student and his fiddle still nearer to Himself; and the doctor used this as an illustration of the value of all efforts in early life towards education, for this solitary student was planting the seed that might, in twenty years, develop into a full-blown appreciation of Bach and Wagner and Mendelssohn. He argued that the efforts were not entirely wasted, and so it may be with any and all of our efforts, made after any or no particular method, in the teaching of dental students; but we are here for the purpose of comparing and discriminating between the various ways of planting this seed. How can we best attain our object with the least waste of time and energy on the part of the pupil? Shall we spend the student's time in training him to carve the form of teeth in soap or clay, or in making drawings of the different parts of the teeth on pasteboard or canvas, or of making sections of teeth, mounting them as type, and printing them in silhouette? Shall we teach histology by having the students cut up sections of prepared tissue, mount them on slides with cover glasses, label and put them away in boxes? Pardon me if I say that the mounting is sometimes neatly done and the labels are often very beautifully inscribed. Shall we teach anatomy by one or even two courses of dissections of the foot or shoulder? There is a possibility of wasting valuable hours on the least direct of profitable methods, and yet, like the boy with his fiddle, the seeds of future studies in histology and anatomy, thus sown, may bring forth fruit in the future. What we need, it seems to me, is a definite adaptation of means to ends. We want a clearly defined and well-marked target—and this target in our schools would be the well-understood object of our education; and then we want a rifle, and not a shotgun, to be placed in the hands

of the student, who must devote all his energies and give infinite practice to the task of learning to shoot at that particular target, with that particular rifle. Pistol, shotgun and bow-and-arrow practice can be indulged in later, but not during the college course. This may seem like impertinence from one who, though an old teacher, has not studied carefully the theories of some of his confreres who are engaged in the so-called technical departments of our complex system; but, in the preparation of this paper, in trying to put down in black and white definite notions and facts about methods of teaching; in reading what distinguished philosophers and teachers of the past and present have said on the subject, and in holding many earnest conversations with professors of history, ethics, literature, law, medicine and dentistry, I am ready at this time to believe that our colleges are working in the right direction, logically, and in the line with the most advanced and philosophical theories of the greatest educators of the present day. The increased opportunities for study in technology and the fair proportion of recitations and didactic presentations of the principles of medical science are well adapted to secure desired results. In technics I should favor, from my present conviction, devotion to training in the special kinds of work that the dentist will be called upon to perform in the laboratory and operating rooms. I would take a boy from the high school or college and train him in the mechanical laboratory—in prosthesis. What a broad subject this is, in itself! Three years is a short apprenticeship to this one branch. I should expect him to make and adapt twenty or thirty practical plates and bridges after he had learned how to use the materials and tools of the laboratory by the most simple and direct plan which could be selected. I should expect him to prepare and fill a hundred teeth in the infirmary, after he had filled a few dozen in the frames and forms provided for him in

the laboratory. This work with his hands—this practical training—should be done under the eye of a well-educated teacher, who would direct the attention to the principles underlying each operation. I should try to avoid complications and distractions by having all the training, all laboratory work, strictly confined to dental operations, or operations belonging to the dentist. He should study neither plumbing, bricklaying nor architecture in the college, and yet all of these might be useful to him in after life, and perhaps make of him a broader dentist. But, "Ars longa, vita brevis," and our time certainly is too short to hamper the student with all the indigestible dainties of many of the modern curricula of studies, advertised by ambitious and competing school directors.

We must adjust our present instruction to current professional needs.

These needs are sufficiently great to occupy not only all the powers of mind that a student may possess, but to fill him with the impulse to continue the study as long as he may be engaged in the practice of his profession.

Nor can we be indifferent to the fact that the medical science of the last quarter of a century has made wonderful progress in the exact methods of diagnosis by the increased keenness of observation made possible by the improved microscope and the almost universal use of this instrument; by the enlarged field of bacteriology, and by the general increased intelligence on the part of the public in regard to medical theories. This state of medical advancement and popular mental activity naturally increases the demand for a higher state of education in these lines than was expected in the good old days of our youth. And our boy who has selected dentistry as his life study and practice must devote a part of each day of his college course to the careful consideration of this medical side of his education. And it is equally true here, that a directness of aim toward a definite purpose should be the guide to the teacher.

The principles of general pathology help in the appreciation of special pathology. Chemistry, physiology, materia medica and general therapeutical doctrines must be taught in a systematic manner, by enthusiastic teachers, after their individual methods. The graded course makes this possible, and the steady development of the student as a liberally educated man is favored.

That the dental as well as the medical colleges of this country are handicapped by the number of students who have not had preliminary education is still a lamentable fact. We must still expect that "future practice" will refine and develop many of our graduates. This fact stares every teacher in the face, at every commencement, as he sits on the platform and observes the graduates, one by one, stepping forward to receive their diplomas. Too many of our students are not really well equipped in mind and manners to satisfy the teacher's ideal. The class is not evenly balanced. A stands high in finger craft, but low in medical theory; B is brilliant in recitation and comprehension of pathological doctrines, but is an inferior workman. Is there any remedy for this state of things? Will any method which we can contrive make A and B equals? "You can not make a silk purse out of a sow's ear," but we can make fairly good leather purses, suitable for use in remote rural regions, where silk purses would not be a la mode.

The best possible method of teaching, the most exacting requirements for admission, and precise systems of measuring and weighing, applied to American students, can not obscure the fact that our volunteer army of rough-riding, sharp-shooting dental students are not all fashioned in the same mold, and can not all be fitted to the perfect ideal, after which we teachers are striving.

Discussion of Drs. Whitslar's and Wright's papers:

Dr. N. S. Hoff of Ann Arbor: I want to congratulate the Program Committee. This paper to which we have

just listened, as well as the one previously read, it seems to me, are the most valuable papers that we have had presented at this meeting. I, personally, am delighted with the paper that Dr. Wright has just read. I didn't know that Dr. Wright was a technic teacher at all. When the chairman of the Program Committee suggested him, I feared he would lead us off into other fields in which we should probably get lost. If I have any voice in the selection of officers I shall nominate Dr. Wright chairman of our Program Committee for the next meeting. I simply rise to make this statement. I suppose I ought to leave this for Dr. Cattell to say. Dr. Wright is a new discovery in our technic field, and we surely will utilize him. That is what we came down here for, to find just such men as he. This paper, it seems to me, gives us a higher idea of the functions of this organization. He has not only given us the philosophy of our organization, what it is meant to do and the reason why it exists, but he has even come down to the pedagogics of it and indicated to us the details of what we must do. So I can not too highly recommend this paper for our future study and perusal. I have been thinking what a splendid thing it would be if we could gather up such papers as this, and establish in our college a course on such important related subjects as this, to our students, so that they might be brought into greater harmony with our methods and teachers. I hope that something of this kind may be done, and in the future that we may have more such papers as this. They certainly would stimulate students to better work, broaden their intelligence and give them higher ideas, and make it much easier for us to present our more pedantic work to them.

I once heard a lecture on prosthetic dentistry, in which the professor spent a whole hour talking about beeswax. He told us what it was and what it was good for, as an impression material. We had no modeling compound then.

He told us that there were conditions of the mouth in which it was not possible to take an impression with plaster of paris so that we could make a plate that would fit when it was put into the mouth. That plaster of paris would take the soft places without pressure upon them as the plate would do when it was put into the mouth. I don't teach prosthetic dentistry, but my experience in didactic teaching in other lines leads me to think that the amount of material furnished by this syllabus ought to give us a course of, at least, one hundred lectures. I wish that I could have those two subjects to teach. I think I could outline a course of lectures on prosthetic dentistry that would show you that we haven't usurped the province of the lecturer in any instance whatever. We haven't taken away a particle of his material. These two subjects, it seems to me, ought to be taught together. The lecturer on prosthetic dentistry ought to teach in perfect harmony with the teacher of prosthetic technics, and in that way the principles involved in the science and art of dental prosthesis can be developd in conjunction with technical principles and details. If you will look in other directions you will see, in our schools of technology, for instance, the teacher of the principles of technical science doesn't go down into the shop and teach the technique of forging, pattern-making, or the manipulation of the lathe. They have separate men to do that work. That is technical work. But they must have the principles also as they attempt to do this sort of work. If any one knows a better way to present these subjects, I should be very glad to have them bring it out. Doubtless we shall find better methods in time, but so far I know of no better system of presenting this subject than we have here presented. If you can improve upon it, if you don't think it is feasible or practical, we want you to say so.

Dr. W. C. Barrett of Buffalo: There is one aspect of Dr. Wright's paper which strikes me very forcibly, and that

is the difference between A and B. How can we place them on the same level; how can we make A and B equal? I need not repeat the distinction he makes between them. Every teacher knows that there are certain students in the class room and in the quiz room who are simply perfect, and when they get into the laboratory and operating room they are nowhere. How can they be made equal? I don't know, and especially in these days of competition, when the schools are all anxious to get students. I want to call your attention to the conditions in the State of New York, however. More than thirty years ago a law was passed in the State of New York, and that law did nothing more nor less in that early time than to simply define who should be considered a reputable, regular practising dentist. There was no penalty whatever prescribed for any infraction of the law, and it was some years before we arrived at the point of making any discrimination before the law for irregular practice. From that time on almost every year we went before the State Legislature and took one step, a single step at a time, until in the due process of time and in the evolution of dental affairs we think in the State of New York that we arrived at a pretty straight status. We have one advantage there, and that is, we have a State Board of Regents. A Board of Regents who are above any mercantile aspect of affairs, governing all the educational affairs of the State above the common schools, professional as well as literary, and they have exclusive control over those schools, over the governing of the colleges, over their curriculum. These men serve without pay. It is an honorary position entirely. They are selected by the Legislature in joint session precisely as United States Senators are selected; hence, they are placed beyond any mercenary condition. There is a system in the State of examinations and the establishment of what are called regenal qualifications or regenal points. Now the law places dentistry

and medicine exactly upon the same plane. The Regents determine the qualifications of every matriculant, and having a high standard they are able to draw the line exactly. The schools have no appeal whatever from the decision of the Regents, and they have nothing to say about the reception of students except to take those whom the Regents say they can take, and who have the Regent's qualifications and certificate. Now then, I think that that partially solves the question. It does keep out certain men of great mechancial ability, but at the same time it does determine this one fact, that no man can enter a school in the State of New York and graduate from that school unless he is thoroughly versed in those basal fundamental things which are so essential to a full comprehension of dental science. Hence, we begin to find in the State of New York that the class of students is better than in other States, and are competent and qualified to thoroughly comprehend the didactic instruction and become good students in that sense, while, at the same time, they have all the qualifications that the average student should have in mechanical ability. It eliminates one feature and one difficulty in regard to the matter, and hence, we find that it is very beneficial to us in the State of New York. I know that all schools consider when they raise the standard that the number of students falls off and decreases, but we have not found it so in the State of New York. Every school in the State, medical and dental, with every increase of the qualifications has simply increased the number of students, and the New York schools this winter have a larger number of students than they ever had before in the world. It is the same in the medical departments. It obtains a better class of students and eliminates the ones who are incompetent to comprehend and fully understand the principles that are taught in the didactic instruction. And it does seem to me that that is a factor which is of very great importance.

Rush school of Chicago has one hundred more students than it ever had before, and it has gone to the standard of the University of Chicago. And it does seem to me that that places A and B more nearly on a level. When you stop receiving men that have not the preliminary qualifications, it places them on a level and eliminates many objections which were urged in the paper.

Dr. G. V. I. Brown of Milwaukee: I have been asked by those who met this morning and last evening representing the dental infirmaries, to get if possible the sense of this meeting with regard to the advisability of adding to the exhibits an exhibit of methods used in the different infirmaries. I do this at Dr. Whitslar's request. In discussing that paper, if the gentlemen will keep the idea in their minds and will define for us whether, in their opinion, it is advisable to bring in those teaching methods or not, it will facilitate matters very greatly. It would bring the discussion directly in line with the other paper, and in order that it may not be overlooked, and to save time, I simply ask that those in discussing kindly express so far as possible some wish in regard to the matter.

Dr. E. C. Kirk of Philadelphia: The difficulties of leveling up the differences between A and B, which is one of the serious troubles of education, has not yet been fairly touched upon. I have always taken exception to the principle, or the axiom that all men are born free and equal in America. They are not born equal in the matter of natural endowments, nor are they born free of the handicap which heredity places upon them. And if we are going to level up the differences educationally between A and B, then we should do as Oliver Wendell Holmes proposed to do, begin back with the grandfathers. Or determine the question as Dr. Barrett proposed to do in one of his rather recent editorials in which he discussed this same matter. There are certain natural differences which can not be overlooked.

We will always have A's and we will always have B's, and there will be certain members of the dental class who will be silken purses on the operative side, and there will be leather purses, or sow's ears, on the other side.

In regard to the effect of such a law as New York has enacted. It will do one thing; it will give us a level standard of preliminary requirements simply upon the quantitative side. It seems to me that our legislative enactments thus far have dealt only with the quantitative side; that is, the laws specify what amount of education a man shall have, but have not dealt sufficiently with what that curriculum shall be. It does not have, in my opinion, the proper selective qualities for securing the best material out of which to make dentists. It deals only with how much education a man shall have. That is a question, it seems to me, that should concern us very definitely. Some addition to our standard of primary requirements which shall, as Dr. Guilford has suggested, deal with the problem of bringing up the man in the pursuance of a dental course of instruction.

Dr. J. Taft, Cincinnati: I think those who have been much engaged in dealing with young men in educational matters have learned that it is an impossibility to place all varieties of students upon a level. The idea of bringing A and B, whoever they may be, upon a level in all respects, even in the educational work which they shall accomplish, is, it seems to me, wholly impracticable. Nature has endowed one man with abilities for a certain line of work. He is physically and intellectually endowed for a particular course, and in many instances you can not wrench him from that course without doing violence to his whole nature and his whole future. Is it necessary that you should place everybody upon the same level? I do not conceive it to be so. Here is a man who has a natural endowment for a certain thing; let him be educated and advantage taken of his

nature; utilize his ability to accomplish that which another man could not accomplish at all. How comes it that we have some men of genius, as they are called; men who tower above everybody else in achievements and accomplishments in a certain line, and on other subjects, perhaps, are inferior and many times very inferior? It is impossible to put a man in a position where you are doing violence to his inclinations and to his natural endowments. In placing him there you do violence to him and you minimize his abilities and his achievements in the future. But the important problem is, what shall we do with these differing individuals? Do the very best thing you can for each one according to his inclination and according to that with which he is endowed. That seems to me to be the correct principle, rather than to endeavor to bring them both upon the same level. It is by studying the inclination of each man, and encouraging it, that we will do the very best thing. It is this that we should look to, and study the nature of the material that is put into our hands. The mechanic who makes a structure studies the nature of the material with which he builds, and selects that which is appropriate to serve the purpose for which it is desired.

In regard to the preparation of students for entrance into the colleges. I think that is a little outside of this question here. I think this subject that we have been discussing is a little outside of it, but it is an exceedingly interesting question, and it is one with which every teacher has to deal. Every teacher finds this problem: What shall I do with this student and that, of a different inclination, of a different kind of endowment and a different inclination in that which he is to study? That is the important question. All that I would say farther is that I should be glad to hear both of these papers discussed directly upon the points which they have presented. The first paper, "Conduct of the Operative Clinic," is a subject which

should, of course, interest those who are teaching operative dentistry. This is in one sense the objective, or one of the objective points of all the teaching that is done in our institutions, and I should like to hear that subject discussed more fully than it has been. The management of the conduct of operative work.

Dr. T. E. Weeks of Minneapolis: It seems that we should endeavor to keep our minds as closely as possible within the channels of thought outlined in those two papers, which is much the same and is certainly broad enough for us. What we desire to discuss and learn is how we can keep from allowing the technic idea to overshadow everything, and at the same time to make that technic teaching lead up to the rounding out and broadening which must occur in the infirmaries and through the means of didactic recitative instruction. Many here are interested in the infirmary, and it seems that our thought and our discussions ought to be confined to the point brought out by Dr. Whitslar, how to make the practice in the infirmary of the greatest good to the student. That, of course, is the reason for the existence of the infirmary, that the student may have an opportunity to put into practice that technical knowledge which he acquires in the laboratory and the knowledge which is translated to him in other ways. I would like to see more attention paid to that question than has been paid to it so far in the discussion.

Dr. J. Taft, Cincinnati: There are one or two thoughts that I want to speak of with reference to Dr. Whitslar's paper. What should be done to give the student the best knowledge in the line which he is to pursue? It is to have everything involved in the conducting of the clinic in perfect condition; all the surroundings, the appliances, the instruments, and all the conditions and facilities that may be afforded should be given to every student in the operating

room. This should be a matter to which the conductor of that clinic gives special attention. The conductor of the clinic should see that every student exercises his ability in such directions as shall educate his manipulative ability, and in such ways as shall more rapidly bring him on to the point for which he is aiming in his work. In order to do that he should have all the facilities that have been referred to. The student in the operating room should have his attention not only fixed upon the examination of the work, how he shall open a cavity, form it and proceed in the successive steps to the completion and closing of it, but his attention should be drawn to the conditions of the patient. The condition of every patient that comes into the hands of the student should receive his thought and attention. He should be so familiar with physiological and pathological conditions as to be able to recognize them and know how they may modify that which he is attempting to execute. We may at times operate for a patient when we have great misgivings from the first that what we are doing will not amount to very much. Then the attention of the student should always be directed by the person in charge to these special conditions in the patients that come into his hands. Is it a man of good health; is it one with some poison, some difficulty in the system that inheres there? All these things that will interfere more or less with the work that is being done, the attention of the student should be called to. He should cultivate the ability of studying these things the very moment that he takes charge of a patient. And that is one objection which arises against putting patients into the hands of the student in the first year. He has not anatomy, he has not pathology and histology enough to recognize or know anything about these things in the first year, and he ought to be thoroughly trained in these things before patients are put into his hands at all. Then the one who conducts a clinic should not only give attention to the

manipulation, to the instruments, the appliances, the modes of treatment and everything of this kind, but go farther than that, and apply the principles which the student has been attaining and working upon in his prior course; he should be in a position and have the ability to utilize this knowledge when he takes a patient into his hands. It seems to me that is certainly a point not to be disregarded. And then in regard to the modes of procedure. How often it is that we find students in the clinic room working in the mouth much in advance of where they ought to be. We find them many times working in the mouth, filling, for instance, cavities of decay, when the teeth are covered with debris; when the first thing that should be done is to put the mouth in a healthy condition, as far as possible, that any disease that may exist in the gums, or that may be anywhere in the mouth or its contiguous parts that will affect the teeth, should be remedied before the operation of filling is taken up. How often is it we find that students are operating upon teeth half covered with salivary calculus, and making them, shall we say filthy, unsightly at least, and in a condition where disease is more likely to be continued. Now these are some things to which every conductor of a clinic should give attention. I have found it utterly impossible to do all that ought to be done in the guiding of thirty or fifty students. I don't believe that any conductor of a clinic ought to have more than ten students under his charge, but we find many a time that one demonstrator or instructor will have thirty, forty or fifty students under his charge, and it is utterly impossible to keep them on the right track.

Dr. W. H. Whitslar: I have nothing further to add, simply to thank the gentlemen for the kind attention which the paper has received, as well as to thank Dr. Hoff and Dr. Taft for their kind words. There is one little thing that I would like to mention, and that is a slight effort on

the part of introducing a new word into our nomenclature —the word operatory instead of infirmary or clinic room. I find this word is proper, and I am sustained in its use by no less authority than that of the Century, Standard, Webster and Worcester. Whether it might meet with your approval, I do not know, but I find it is perfectly correct to use, and to my mind it sounds better than the word infirmary, and in speaking it requires a less amount of energy than either clinic or operating room.

Dr. C. M. Wright: I don't know that I have anything to say in regard to this matter now in closing the discussion, excepting a word in regard to Dr. Whitslar's paper. I was very much interested in it. Dr. Whitslar always writes a good paper.

In regard to some of the points in my own paper, I beg to say that I have never felt so modest in my life as I did to-day in coming before this society of teachers of technic. I appreciated that they were teachers of a special line, and that I was not in that line to-day. I appreciate Dr. Hoff's position as a teacher of materia medica, being interested in this basal main principle; things that we want for study. As I said, what do we care for especially stereotype dentists unless they have that training in their fingers, and all we want to do now, it seems to me, is to find out by our syllabi and various things that have been presented here, the best way to teach that main particular branch. The others follow.

METHODS OF TEACHING DENTAL PATHOLOGY AND THERAPEUTICS.

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The subjects included in the chair under discussion comprise what may be fitly termed Dental Medicine.

As with the practice of medicine in general, the methods of instruction applicable are three, didactic, clinical, and

laboratory. It is becoming more and more widely admitted each year that no one of these methods is alone sufficient to give a student a comprehensive knowledge of the subject. Each of the methods has its manifest advantage and definite purpose, and each its limitations.

A knowledge of the subject itself comprises a knowledge of abstract principles which have concrete application; of a practical adaptation of means to ends, and a familiarity with experimental and confirmative laboratory work; these three aspects representing the desired object in the three methods of teaching named. It is assumed, and many of us know what a great assumption it is, that before a student enters upon the study of pathology and morbid anatomy, that he is familiarly conversant with physiology, histology, physiological chemistry and materia medica. While it is true that but few students measure up to this standard, the number that do is increasing year by year. It is a problem, second only in importance to that of manipulative ability, that this standard should be attained.

I accept, as presumably all of us do, and as I have set forth in my Text-Book of Dental Pathology, Therapeutics and Pharmacology, the fundamental principles of general medicine as identical with those of dentistry and recognize the fundamental sciences to be chemistry, physics, biology, in its broad and special aspects, and pharmacology. My method of unfolding the subject is substantially that contained in the text-books. General pathology is discussed specifically as morbid physiology. Beginning with disorders of simple cells; affections of the vitality and nutrition are examined analytically, proceeding then to general disturbances of nutrition; to a consideration and classification of disease causes, which introduces naturally a study of bacteriology; passing to general and local disturbances of the vascular system, paves the way for a comprehension of such processes as infective inflammations, septic poisonings,

fever, and next special illustrative diseases, both functional and structural. The preceding exposition, of common application to all medicine, represents basal principles which are of course modified by the anatomy, physiology and physiological chemistry of the special field to be studied, in this case the teeth. The mode and origin of the teeth and associate parts are taken up with the special purpose of elucidating the surgical anatomy of the dental tissues, the teeth in toto and their surroundings, a subject which should receive more specific attention than it does at present. Disorders during and following development are discussed, and a survey, generalized as much as possible, of dental deformities, is made. Then diseases of the dental tissues are taken up seriatim: first, those of the enamel; second, those of the dentin; third, those of the pulp; passing then to affections of the pericementum, and of the alveolar process. Affections of the soft tissues about the teeth; infections arising from the mouth, and a few other subjects are then discussed, which completes the scope of treatment of nine hundred and ninety-nine out of a thousand practitioners. The diseases of each organ are classified into natural groups, and as nearly as possible taken up in sequential order.

Pharmacology is treated upon the rational in contradistinction to the empiric method. The chemical composition and structure of each drug is examined, a close inquiry made into the mode of its local and general action, and the data obtained are fitted into those of the pathological anatomy of the teeth, that is, a therapeutics is deduced from a primary examination of pathology and pharmacology. The course as outlined composes some eighty lectures; wasting no time on extraneous matters. A discussion of clinical and laboratory methods of instruction would require two long essays, so that the present discussion is confined to didactic methods. In this, if in no other

nch of dental teaching, the didactic method will always d a place, and a prominent one. No one will controvert t purely technical matters are much better taught after clinical and laboratory methods. Didactic teaching its own specific field and purpose, which is supplemen- to, not substitutive for clinical and laboratory work. object of the didactic teacher is primarily to teach a lent how to think; to think systematically. If the stu- t be already trained in deductive and inductive think- , the materials for the exercise of these mental functions set before him. If he lack these qualifications, the prob- is two-fold: to teach him to think abstractly after the methods named, and coincidently to furnish his mind h appropriate data. Some data lend themselves to this cess much more aptly than others; to generalize, facts lata which have close and clear association with other a are the applicable ones. The end and purpose of di- tic teaching are defeated by the use of improper data. psychology of this matter is interesting, and all-im- tant. Significant and essential data are presented in an ending series so that the student's mind classifies and lds as the teacher expounds; and when a sufficient num- of data have been presented, a generalization is made, a principle enunciated. This is the inductive aspect the problem. I take it that the enunciation of princi- s after the method given, and next, deductions from the eral proposition are the true functions of didactic hing. Accepting a general proposition, which of course ws in abstractness according to the number of data en- ed in its building, mental deductions logically warranted the general proposition are made. Much time can be nt on this aspect of thought engendering, as it is the se and method of thinking which will be most immedi- y serviceable to the graduate. The didactic teacher has pathways for reaching his pupil's think centers—the

ear and eye. He imparts knowledge, sets trains of thought in motion by speaking and by the exhibition of pictures and figures.

We all know that the greatest obstacle to the induction of thinking, of close attention, is monotony. It only requires a sufficient degree of monotony of stimuli to induce hypnotism. Somnolence in any degree is inevitably induced if the impressions received through eye or ear, are not sharp, and they will not be sharp, if the teacher talk in a monotone, and have no gradations of emphasis. Nor will they be sharp, if the pictures or objects presented for examination are not made as striking as possible. Bodies of men, as intimated by the psychologist Baldwin, are divisible into two classes, those whose sharpest impressions and mental responses are called forth by visual images, pictures, scenes, etc., and those who respond most readily to impressions received through the auditory nerves. The material presented to the eye is largely in the form of pictures; these may be supplemented by large carved models, and in some instances by models moulded before the class. As the object in presenting the pictures is to make as vivid a visual picture as possible, they should be constructed to this end. Vividness is conveyed by three means, sharpness and emphasis of outlines, by light and shadow and by colors. In the earlier stages of instruction these features are much more important than is fidelity of detail; that is, to the novice a diagrammatic representation of an object conveys a more comprehensive idea of the object than does a detailed and accurate picture. Discrimination is necessary as to the selection of pictures, while it is admittedly true that text-books contain many excellent and useful illustrations students have more or less familiarity with them, hence they do not fasten the attention as do specially devised pictures and diagrams. It is, I believe, a distinct advantage to vary sets of pictures from year to year. In the

; of pictures, outlines should be bold and marked, be boldly drawn in black against a white back-. In representing a structure such as a tooth and roundings when there are several tissues, colors are used, striking colors, with the idea of contrasting adjoining structures. Red, flaming red, is of course ble in representing vascular structures. Discrimina-parts is aided by the contrast of colors; and attention l by their number and variety.

y of these drawings can be improvised, and made he blackboard in colored chalks, during the course cture. It is in the experience of nearly everyone tening to an hour's unbroken talk is attended by a attention and thinking which soon reaches a climax; ucceeded by a period of wavering attention, followed ell of more or less indifference which passes insensi-o impatience. Students furnish no exception to this that means supplementary to the mere talk are nec-to antidote the inattention. The problem divides nder four heads: First, a period to fix the attention; a period to hold the wavering attention; third, one nteract the indifference, and fourth, to divert the o prevent indifference. These four stages, repre-degrees of attention or inattention, represent four s of indicated mental stimulation, the greatest being The first stage is safely passed over by a clear state-nnouncing the position of the subject matter, its meaning and definition. The currents of thought n turned and the attention held by an unfolding of ject matter, and the successive steps of reasoning ap-e. The next and more pronounced diversion, when tion of attention is necessary, is made by the "stage onstration," when blackboard drawings with colored are most useful adjuncts. A sharp diversion and re-of attention are secured for the last quarter by show-

ing the practical and direct applications of the subject matter. As an illustrative example, let us say the lecture subject is active hyperemia of the pulp. First, the general idea conveyed by the term is stated; next the nature of the pathological changes which exist (plentifully illustrated) are shown; when a definition can be framed. The second period, more interesting to the student, deals with the causes and symptoms of the condition; when a more absorbing matter, the morbid physiology, is taken up, and its association with symptoms and morbid anatomy are worked out. The attention is then stimulated by discussing, how is this condition recognized, and what are its probable results as to the future. The fourth stage and lastly, my dear brethren, is, what shall we do, how shall we do, how shall we treat it. This is always a stimulant subject to a student; general indications are laid down first, and the period of impatience combatted by an exposition of the direct practical application of the teaching.

Dr. A. F. Webster of Toronto, Canada: In teaching, the first thing to do is to get the student's attention; without that you do nothing. Then the teacher must have a teaching knowledge of his subject; knowing his subject in a general way is not knowing how to teach it. He should always be dignified and self-possessed. That is a very important thing. Some men come into a lecture room and walk back and forth across the floor while they are delivering their lecture. That is not the way to hold the attention of the students; they are busy watching you walking back and forth, and are not paying attention to what you are saying. For instance, you see how much attention was paid to the reading of Dr. Brown's paper while this chart was being put up. You were looking at that thing going up. Next, you must have a clear, audible voice and use good language. I can not lay too much stress on the clear, audible voice. Be earnest and energetic. That means a

ole lot to the teacher and it means a thousand times re to the pupil. See every man in the room, hear every nd and know every cause for inattention. See every n, have your eye on his eye and draw his attention. it how you will. Why do we have inattention? Poor ting, lighting, heating and ventilation of lecture room much to do with it. Let a man sit in an uncomfortable t for an hour. I have sat for five hours listening to lec- es with only five minutes intermission. What condition s I in to listen to lectures at the end of five hours? ne at all. If a man pays attention for an hour he has ne very well. Lack of knowledge is another point. ice, energy, sight, hearing, wandering from subject, ding the lecture. Some men will read their lectures ht straight through. That is a mistake. Another thing hat the subject may be too difficult or too simple for the dent. Following in a rut from year to year. You will d some men have read lectures twenty years ago that y read to-day. This is an imposition on the students. w I want to say something about a method of present- a subject before a class. Ten minutes of the hour you nsume in either writing on the board yourself all the es that you need for that hour, or have an assistant do for you, and have students copy them. Then lecture is ceeded with from the board. Now you go on with the ture, and you know that there is some man not paying ention; bring in his name in the sentence, get his atten- n. At the close of the lecture give time for the students ask questions; in fact, give time any place through the ture for a student's question. Now after you have dis- ssed the question, if you have a demonstration following, ke your demonstration promptly; make it once. It is nistake to make several demonstrations. Make one good, an, clear demonstration and know how to make that be- e you begin and then stop right there. If anyone has

not gotten onto that, give it to him privately. You have no right to waste the time of all the other men for that one man. The next day, before you do anything else, have a recitation on the last lecture, and anything that is not understood by the students, teach it. How to conduct a recitation: I have listened to recitations in every school that I have ever been in, I think, and I have never heard one conducted right. For instance, Mr. Brown, how many teeth are there in the upper jaw? Smith and Jones are sticking pins into each other on the other side of the room. State the question this way: How many teeth are there in the upper jaw—Jones? In that way you have them all thinking, but the other way you have one man thinking and the rest playing. Never ask a question that may be answered by yes or no. Never ask a question that may be guessed at. You don't want that. You don't find out what he knows. The object of a recitation is to find out how much a student knows, how much he has grasped of the question. Of course, the difficulty comes in the way the recitations are conducted. If you are going to conduct your recitation for the purpose of examining, and keep tab on the answers, then it is more difficult, and it is also difficult to conduct recitations for a very large class. You have got to have every man's eye and there are a thousand methods of doing this. Keep the attention. Keep that before your minds. If you remember nothing else I do hope teachers will go home and say I will keep the attention. And if anything goes wrong either dismiss your class or ask yourself; who's wrong in this thing, is it the pupils or myself?

Dr. H. A. Smith: I would like to ask Dr. Webster to describe the method of Prof. Senn's teaching. I have heard him say that he was the ideal teacher.

Dr. Webster: Prof. Senn is, I think, the ideal teacher. The reason is, the energy, the force, the knowledge. His

d of presenting the subject is, I think, very nearly ave given it to you, except, probably, his recitations. es not conduct the recitation himself. The recitation ducted by a recitation master. I have just used his d.

STEEL TECHNIC.

GEO. H. WILSON, D. D. S., CLEVELAND.

technic teaching, we mean an education by the hand l as of the hand. It is elevating the sense of touch to me plane as the sense of sight and hearing, in the ac- ion of knowledge. They are the avenues to the brain. rain, or mind, can only be developed by exercise. exercise must be either active or passive. Active ex- is stimulative, healthful and productive; while pas- xercise is sedative, debilitating, enervating and tends generation. If the sense of touch is to be used to de- the mind, it must be used so as to stimulate and ac- exercise the mind. As soon as the brain becomes l to the impressions made by the sense of touch, it to become passive, sluggish and, if long continued, to retrogression.

om these statements, I argue that manual training be progressive; at no step can it with prudence be itted to become a mere repetition, or the mind will be- passive, willing the hand to do without instructing In order that hand manipulation may become educa- l; we must keep the mind busily occupied, reasoning and why, while the eye must be constantly employed, ving the movements of the hand, so that the work is precisely as directed by the master, mind. If a young desiring to study dentistry, should be placed at the and kept constantly at gold filling, or at the labora- bench and kept continuously at vulcanite work for

three years, he would probably become very proficient in the chosen line; but what would probably be the result, after the young man had been in practice for himself ten years? I think we are justified in assuming that he would become a very narrow-minded man, and probably retrograde in the thoroughness with which he did his work. Upon the other hand, if we judiciously divide his time between the collateral branches, but all bearing upon the main subject, we will develop his perceptive and reflective faculties, and thereby broaden his mind so that when he goes out into the world, he will continue to develop, and will become an honored and respected citizen.

Our profession is a most fortuitous one in that it has many sides, and favors giving its devotee a general cultivation. Ten years have passed since our president formulated and presented to the profession, his ideas of technic instruction. Truly can we say the little stone that started down the mountain-side has gathered unto itself until it has become a great boulder. The thought of a decade ago, is to-day organized and incorporated into nearly all of our schools, and is domiciled in this society, which for a healthful, beneficent influence upon our profession, is second to none. Each year of the life of this society has seen more rapid strides upward than the preceding year, and the coming year bids fair to be the most propitious of all.

I offer for your consideration, as the line upon which we shall advance in the prosthetic department—Steel Technics. Believing as I do that there is no technic course as profitable, from an educational point of view, for the time employed, as Steel Technics, I feel this should be developed and made an integral part of every school.

In the '97 Ohio Dental Journal, Dr. C. R. Butler gives some very valuable information upon "Working of Steel." I quote the following from one of the articles: "There is no feature in manual exercise that will bring out such con-

ant power of hands and head, as the forging and filing ape of metals, all of which are a most valuable acquisi- for a dentist."

r. Corydon Palmer says, in answer to the question as s opinion of the value of steel technic for developing ipulative ability: "He that would a good edge win, forge thick and grind thin." Several of my students told me that they consider our steel technic course, for ime required, the most profitable. It certainly should onsidered as an advanced technic course, as its require- s are quite exacting of the students. I place it next to last of my technic courses; orthodontia technic only wing it.

e sometimes have the criticism made in regard to technic, that "It is not practical; that the dentist will make his own instruments, because he can buy them cheaper in the market." We contend it is most practi- or what it is designed. The object is not to save pur- ng instruments; the manufacturer certainly can pro- them at a far less expense, if time is considered. The of steel working is as a means to help train the hand, nd mind. In forging steel, it requires precision and ion. The hands must work in harmony, the eye must ly see the result of each blow of the hammer. The must foresee the direction of the next blow, modulate orce and estimate the result. The student will very learn the necessity of précision and decision, as a care- r illy-directed blow will probably necessitate much un- sary work. The training of the eye in the color of ot steel is valuable, and will require concentration of ght. The filing will require much more time, and if work is well done, it will require that patient, pains- g care that is so essential to the successful operator. ills the eye in form, to detect defects in plain and d surfaces, and lack of symmetry. It develops pre-

cision in the formation of angles and curves. Tempering the instrument is another valuable exercise, training the eye in color, and exercising the mind in concentration of thought and promptly controlling the hand.

Forging, filing and tempering have developed a better appreciation of the physical and chemical properties of steel; the use, care and abuse of the instruments with which his future work is to be done, better than any amount of lectures, per se, can do. It gives a working knowledge, founded upon which an hour in the lecture room can be made most profitable; while without this laboratory experience, the lecture room would be nearly barren of real instruction.

Steel technic is an adjunct to instrumentation as taught by the chair of operative technics. While it is hardly practical to have the student construct all of the forms, enough can be required to thoroughly impress the classification and formulae upon the mind.

I do not believe filing and shaping of brass wire is to be compared in usefulness to working steel. The latter has the advantage of being real, and making the impression upon the mind that something has been accomplished of practical value, while the former is only an imitation and can not be put to service.

There are but few implements required of a school which teaches this work. It will necessitate having a forge, such as the "Cyclone" No. 20, or some other good make. A few anvils of about thirty pounds weight, tongs and forging hammers, one each for each anvil. It is well to have the floor covered with sheet steel and the anvil blocks made fast to the floor.

The students should have at least three files. I recommend one eight-inch flat, number naught, such as the students use in operative technics; one four-inch, number four cut; each of these files should have one safe edge. One four-inch, half round, cut number three, or four. One sheet

nber naught emery cloth, and one of crocus cloth, but ent emory cloth will do very well in the place of the .

ery worker of steel has his favorite make. Dr. Cory-Palmer says the best steel for dental cutting instru- is Stub's Steel Wire. Dr. C. R. Butler recommends ; Jessops; and Miller, Metcalf & Parkin, Crescent Works of Pittsburg. I am using in my class work on Dental Steel, manufactured by Kidd Bros. & ner of McKee's Rocks, near Pittsburg. This steel, I is quite extensively used by some of our instrument s. I have found it a very nice working steel; fine taking a high temper and holding a good edge. The facturers' claims for this special brand are: It is equal best makes; that it analyzes lower in phosphorous and ır than any other steel upon the market, making it and mild; that it is distinguished for its high temper, structure, fine grain and, uniformity of quality and r.

require our students to make from new steel: One nt and one biangle chisel; one triple contra-angle, and btuse angle hatchet; one discoid excavator; one spat- one cleoid scaler; two drills, spear points, numbers (7) and eleven (11) Martin screw plate; two taps to pany the drills; and one double end wrench.

ck's formula and gauge are used in giving the instruc- for these instruments.

	Shaft.	*Shank.*	*Blade.*
ght chisel	65-100	20-40	30-10
gle chisel	65-100	20-40	20-9-6
het	50-105	15-40	20-8-18
het (Triple contro angle)	50-105	10-45	5-3-28
oid	50-105	12-43	25-2½-6
ula	50-110	-5	60-35
d (Scaler)	50-105	12-40	20-7-18
ure cutter	50-105	12-43	5-(80-)4-28
Clevers { **R**	65-100	35-45	35-(72)-4, 1-10
Clevers { **L**	65-100	35-45	35-(78)-4, 1-10

s, two spear points, Nos. 7 and 11 Martin crew plate.

. To accompany drills.

ole end wrench.

Three lectures are given: The first as an introduction, upon the composition of steel, and how to heat, forge, anneal and file steel. This is immediately followed by a demonstration. Second lecture and demonstration—how to block out and shape an instrument. The first demonstration taught straight, cross and draw filing; the second, round filing. Third lecture and demonstration—how to blue the handles, harden steel and temper each instrument. The time required for this work is about sixty hours.

I believe it is always better to select such stock and methods as will favor the student producing the best work, providing it in no way interferes with the educational process. For this reason I select the octagon steel rods. I require all the shafts to be cross and draw-filed, which is valuable in forming a flat, smooth surface, but is nothing in labor compared to filing an instrument octagon from a round rod, and with the limited time at our disposal, we would not be justified in requiring so much preparatory work.

The steel should be heated to a bright, cherry red, never beyond a bright red. An inch or an inch and a half of the rod is to be drawn out to about twice the length. This is done by placing the heated steel flat upon the anvil and striking one decisive blow with the forging hammer, then turning the steel one quarter over, and striking two decisive blows, one to even up the steel and the other to advance the work. This is continued, turning the rods back and forth, striking two blows each time, until the steel loses its color, when it must be heated again. After it is forged square, it is forged octagon. Then it is easily forged round. The steel is then heated to a red, and placed in the hot coal near the fire and permitted to cool slowly. When the steel is cold, it is ready for filing. Place the shaft horizontally in a vise, the jaws of which are copper capped; when each octagonal surface is cross-filed with an eight-inch naught

is then draw-filed with the number four cut file, and
smoothed by placing a piece of oiled emery cloth
he file, and drawing.

blocking out and shaping must be done according to
lividual instrument. In tempering the instrument,
ial method should be permitted, as the whole object
work is to educate; so we permit nothing but soap to
t scaling, and water to fix the temper when it is in-
by color.

uing the handles, it is better not to let the flame touch
el. This can be prevented by placing a piece of clean
ron upon the gas stove, and placing the shaft of the
nent upon the sheet iron, and changing its position
color indicates the need of more or less heat. The
and blade are then hardened, and temper drawn to
quirements of the individual instrument; then the
s polished for a final finish.

ke it for granted that all teachers of prosthetic tech-
derstand the pointing and tempering of instruments,
opine the reason more schools have not introduced
echnics is because they have not become cognizant
great aid it is in developing manual dexterity, and
y have not a knowledge of forging and filing steel;
I have been a little more explicit in describing the
l of forging, filing and bluing.

mmend steel technics as a claimant for the consid-
of every dental school of this association.

J. D. Patterson of Kansas City: I don't know why
elected to speak upon this subject except that I criti-
he steel technic in Chicago a year or more ago and
anted to have me do the same thing over again. I
o anything more now than I did at that time. My
is that the steel technic course as advised by the es-
and others who have reported upon technic, is a
of time that could be very much better occupied

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in other practices. I believe, as Dr. Wright said this morning, that there is a possibility of wasting the most valuable time in the most valueless work. The best technic work is that work which the student must in after life do in actual practice in the mouth and in the laboratory. If we were at a loss to find any of that sort of work it would be a different thing, but when there are such multitudinous things that we can do, then why, in the name of common sense, do we spend three or four weeks, as is outlined in this paper, of the Freshman's time in learning to make these instruments? I would put aside entirely the question of the necessity of making instruments, as the essayist has done; that is out of the question. The question is, how to develop the best manipulative ability, and the best manipulative ability for after work in practice can, as Dr. Wright said, be had by work in the line of what we must do in actual after practice for the patient and in the laboratory. That is my position, and while I differ from others you will kindly allow me to express my belief. I consider it valuable time put in in a valueless way. At the time when I was taking the technic work I was also studying shorthand, and the work in shorthand which I did at that time has been of infinitely more value to me than the work in making instruments ever has. What use was my long study of steel technics; what use is it to me to-day? None whatever, unless I gained a little manipulative ability. I gained more in the practice of shorthand, and I gained more in numberless ways. But we don't want a shorthand course in our colleges; neither do we want a blacksmith shop. I think we have gotten beyond that. Thirty, forty or fifty years ago it was a different thing. We all admit that:

> "The smith, a mighty man is he,
> With large and sinewy hands;
> And the muscles of his brawny arms
> Are strong as iron bands."

hat do we want with that? We don't want the hard
and the brawny arms. We want the delicate manip-
n. That's what we want. We don't want the black-
at all. There is more manipulative ability, to my
, to be sought in a barber shop. The manipulative
y of the expert man on your face is considerably more
nore in line with what we have to do about the mouth
there is in the steel technic course. But we don't want
arber shops in connection with our schools. Why, the
er in the butcher shop gains more manipulative abil-
hich is of more benefit to the dentist in after years,
does it right, but we don't want a butcher shop in our
ls. Now, I don't intend to cast any reflection at all.
is steel technic course as outlined by Dr. Hoff, let me
some of the things that are outlined for the student to
. "Make taps for threading nuts." Do you know
it takes to make a tap to accommodate the screw of a
any of the regulating appliances that we use? Why,
only the expert men in instrument-making who can
a decent instrument. I can make a better one than
nan on this committee, I venture to say. The taps
ake which are small enough for the work are
utely useless so long as I can secure any amount of
perfectly made, and it takes an instrument maker
to make a nice tap of a small diameter that will do
vork that we want it for. You could make a great
ne; that is no trouble at all. "Make a punch from
teel, forge and file." Well, it doesn't take much work
that. Manipulative ability can be better put in on
things. "Make filing instrument for finishing nuts."
does beat me. "Make straight gouge chisel." "Make
let plugger." Just think of it; when people who have
mechanics all their lives have the greatest difficulty
aking a decent mallet plugger. "Make a serrating
." What for, for the manipulative ability gained?

Why not put it on those things which are in the line of our work which we do every day? All that is indicated here is a short course of tempering, softening and hardening of steel. That is all that is necessary. That is all that I want in my college, and it is all that we have. We have too much to do which is in this line that I have spoken of. Of course, I am speaking about the general run of practitioners as we take them. We must have specialists. There are men all over the country who are dentists, and yet, who are formulating instruments and making instruments, new ones for the manufacturers. I am not talking about those. I had a good many things that I desired to say, but I can't think of any of them now.

Somebody told me a story about my friend, Dr. Gray. I find in talking with a great many of the older practitioners that they thoroughly believe with me in the uselessness of this steel technic course; among others, my friend, Dr. Gray. You know, down in the mountains of Tennessee they have what they call razor-back hogs. They roam over the mountains, I am told, and they range about over the hills. They have long tails and you can hear them crack their tails a mile away. A friend of mine told a story on Dr. Gray. He said that his grandfather one or two hundred years ago met Dr. Gray down there. He was not as old as he is now, and he was ranging over those hills chasing those razor-back hogs. He had commenced this technic course, and they went farther then; they wanted him to forge the iron out of which the dental instruments were made. His grandfather said, "What are you doing?" "Why," he said, "I am chasing these razor-back pigs. I am going to be a dentist, and we have got to learn how to make our instruments. We have got to know where this iron comes from, and you know these pigs secrete pig iron and I am going to get this pig iron." Well, Dr. Gray tells me that he don't believe in this now.

)r. G. V. Black of Chicago: I had not thought of dis-
ing this paper more than to commend it. I have been much occupied with other things to give it sufficient ight. The object of such a course is two-fold: First, foremost always, the development of manipulative abil- the training of the hand and the eye. This is the es- ial factor. One person may bring this out by the use teel; another may do it by the use of ivory; another he use of soap; another by the use of modeling com- nd; another by the use of clay. Now it becomes largely estion as to the aptitude of the men. Dr. Wilson may his pupils better by the use of steel, Dr. Harper by use of ivory, Dr. Goslee by the use of something else, so on. In each the endeavor and the results are practi- y the same. To my mind, if we could have sufficient , the training in steel would be better than any other item of training in technic work. But steel is hard ork, it is comparatively slow, it takes time, and we can all give the time that is necessary to steel. We have a wonderful exemplification of this training lately, of ffect upon men and its effect upon nations. A young at Santiago asked for a shot at a flag on the fortress, was given the liberty by his commanding officer to fire e shots. He had had steel technic, he had had a train- in steel. He sighted the gun, and although the flag two miles away, the first shot tore away the flag; some ads were hanging; with the second shot he tore away stones about the base of that flag staff, but it didn't . "Well," said he, "I will cut it off." The third shot ut it off at the base. You will find no man able to do things who has not had steel technics, who has not a careful mechanical drill in metals. I don't think that can be disputed. Then take the next instance when vera's ships were torn to pieces in such short order; see superiority of the men who had had the drill in steel

technics, who were mechanics first and gunners next, as we all know those upon the other side were not. That was an exemplification of the effect of this class of mechanical work upon the minds of men. The mere sighting of those guns was not steel technics in itself, but it has been found that the man who has had this careful mechanical drill is the man who knows how to do it. I should like very much if it were possible, to go farther and teach students something of the different qualities of steel or the qualities of different steel. One of our difficulties in dentistry is to obtain instruments that are really good. We are using instruments all the time, and we require the best of steel. When I go into my laboratory to point up some instruments, I take the bunch of instruments and do the work as it should be done. Do I know where this steel has come from; do I know the grade of the steel in those instruments? If not, I can't do it properly; I will have to test that steel first and learn its grade. I have worked in steel, brass, and copper a good deal in my time, and I think I know something of the value of that kind of work, and I should like it if students could be taught to know these grades of steel when they examine them, but we can't teach our students everything. And each man teaching operative dentistry or prosthetic dentistry should use that plan in which he finds himself successful in bringing out the ability of the boys. It is not a necessity that Dr. Wilson uses the same plan that Dr. Goslee uses, or that Dr. Harper uses the same plan that another man uses; that is not a necessity, but each man should have some regard for his personal aptitude and his personal power in directing and bringing out the ability of the students whom he is teaching. So that I shall agree that the steel technic is a good thing, and especially is it good in connection with the fact that we must learn instrument forms; we must use instruments of steel. In all of our work we are dealing with

el continuously, and I find, as a matter of fact, that it es a good while and it is an expensive business to the lents before they learn to take any proper care of their instruments. The student does not know the nature eel. I would have every student drilled along this line el technics if I could, but if a teacher has more apti- in a different direction I should not send him away that in order to introduce the steel technic.

Geo. B. Snow of Buffalo: While Dr. Wilson's is, in the main, a very able presentation of this sub- there are a few points on which I differ with him. ubt the expediency of attempting to teach students to forge steel. If I were to attempt it, I would begin some softer metal; as lead, for instance. In drawing steel under the hammer, it is of the first importance the hand should always turn the bar exactly ninety de- es; that the bar may have and preserve a rectangular tion. If this is not done, and the section becomes rhom- oidal, the effect will be to induce a crack through the cen- er of the bar, and render the steel useless. For this reason, would begin with a softer metal and not forge any steel til the student had acquired the knack of so turning the as to preserve its rectangular section.

The beginning of instruction in working steel should ude experiments to show its working qualities. Let the dent be provided with a piece of Stub's wire, and in- ct him to heat one end to a low red heat, and harden dipping in water. Then to bring the other end to a yel- heat, and dip that also. Now by breaking off the s of the wire with pliers, he will find that one end uite strong, and the other very brittle. An examina- of the broken ends with a magnifying glass will dis- e a great difference in their texture, and he learns that end of the wire, that which was heated the most, is urnt," and is unfit for use. Now if he breaks an instru-

ment which he has bought, he can examine its broken end intelligently, and judge whether its material is good enough to admit of its being repaired to advantage. Then he is given a piece of softer grade of steel; a wire nail, for example, and he finds that it cannot be hardened. That is another thing it is well for him to know at the start.

Now he is shown how to reheat and anneal his steel wire, and is instructed to file it to a true taper, and reduce it sufficiently to admit of its being made into an excavator point. It will usually require more than one trial before he will be able to file it properly; his efforts usually resulting in making a quicker taper as the end of the wire is approached, and thus not leaving sufficient material at the end for the fashioning of a blade. Then the blank is made into a hatchet excavator, and further instructions are then given in hardening and tempering. In this way, the instruction is given, and all his failures made on an inexpensive piece of wire; which can be worked upon over and over again, and he does not attempt making an actual instrument until there is a reasonable certainty of his not spoiling it.

There was nothing mentioned in the paper about serrating plugger points. The small points more commonly used are easily serrated, and I would by all means recommend that such instruction be given that the student may make or repair these more easily made points. For serrating, the proper file is a small "Barrette" file, No. 8 cut, made by the Nicholson File Co. This file is of a flat triangular section, the base of the triangle being file cut, the other two sides smooth. The two smooth sides should be ground away at an angle of sixty degrees with the base, until the file teeth are ground into; making a serrated edge. The file will now cut the "V" notch required in serrating, and by using the edges of the file alternatly, either side of the serration may be filed at pleasure. Nearly all the

of inserting gold fillings may be done with flat or d points, having three or four serrations. These will me dull by use, and while they will then answer for nary work, if a corner is to be built on an incisor, there be much more certainty of the result if the points are fresh and sharp. In my own case, I would dis- to attempt such an operation unless I had first gone and sharpened my plugger points.

the matter of tempering, the student should be shown difference required in the temper of a thin-bladed ex- tor, to be used in dentine, and the chisel for cutting nel. The latter should have a very hard temper; so that the edge, if thin, would chip out, and to prevent the edge should be thickened to about eighty degrees. n the matter of drawing the temper; having the shank bend of the instrument a blue, or spring temper and blade a lighter or darker yellow. The use of the pliers piece of heavy brass wire, to be held against the edge arry off the heat, and so allow the spring temper to be ied over the bend of the instrument without softening blade too much. These require considerable instruc- before the student will be at all proficient.

he fact is that with our limited time, and the great num- of subjects to be covered, it is difficult to give thorough ruction in steel technics without consuming more time can be spared to it. I therefore would limit the in- ction to that required for repointing and reserrating the e simple instruments, and this I deem of such value that ould not willingly omit it. Many of our graduates find nselves, for a time at least, with more time than money heir hands, and if they are able to save themselves a for repairing instruments by spending an hour or two he laboratory, it is to their advantage. Again, it is etimes the case that in the course of an operation, an rument is required of a different shape than those the

dentist has before him. How much better it is to be able to produce what is wanted by five minutes' work, than to take the time to send for it, with the chance that the directions given have been misunderstood, and that the instrument when it comes, is unsuitable. I believe that by proper attention, a student may soon be able to produce instruments of the more simple shapes for his own use, better than he can buy, and for these reasons, I believe the subject of steel technics to be one which should receive, at least, its share of attention.

Dr. J. P. Gray of Nashville: I heartily agree with Prof. Snow in some things that he has spoken of, but I believe we are carrying this steel technic entirely too far and too fast. I do not believe we should take up the time of the students, when they have such a short time, in teaching them instrument making. I think every student that comes into school ought to be taught the principles of tempering and possibly pointing of instruments, but we have not the time to teach much more than that. A student ought to be taught something besides that. The truth of the matter is that we are going just a little too far on technic, and are trying to make dentists that are better than the men that have gone before them. We can not hope to do that. The duty of the schools to-day is to lay a foundation, not of so much practice, but of scientific understanding; they will get the technic. I want to bring my students to work in the mouth as soon as I can, bring them in contact with diseased conditions of the oral cavity, not making instruments. The student can buy instruments, and he can buy a great deal better ones than he can make, and it takes up the time of a student for nothing but simply to teach him technic that will not come very much into play when he gets into the operating room. I think we ought to pay a little more attention to the didactic work and to class recitation. If a student does not know how to temper and point instruments

little while he is not much of a mechanic to begin nd if he has learned to temper an instrument he can ome kind of a point on that instrument, and if he t do it he never will learn it. I want to say that I ny friend, Dr. Patterson, ought to "set them up."

G. V. I. Brown of Milwaukee: I have an object with me here, and perhaps it will interest those who erested in this subject to look at it. In the exhibit ny college you will find some instruments. Every-was done by the student, from the crude piece of ven to the nickel plating, and the fact is that that , now in the senior class, is one of the poorest opera-at we have in the class. And therefore, whatever od results of this might be under ordinary circum-, this is one object lesson in which the time was cer-lost. Since I have taken charge of the school we ovide the students with blanks, and those blanks, of come from the manufacturers ready for the students e the instruments and form them and study the and that sort of thing, and merely pointing and tem- them. In that way I think we have saved a great f time and I think have given them the essentials course.

R. R. Freeman of Nashville: Down in our country d to eat hog and hominy, but they got the habit of ncing for the comfort of men and their growth, We had an elegant lady in our country who used te her neighbors in, and she would set out a course On one occasion there was a minister who had been ng around through the country, and he was invited of these dinners. Course after course was placed be-m, and he did justice to each course until he discov-at there were still more to follow, and he had dis- enough to say: "Sister Perkins, if it will suit you well, allow me to skip to dessert." Now you present

an elaborate menu here that no college in the world can follow. If the student were to receive all the benefit of all the technic teaching that emanates from the minds of these gentlemen, you would have to increase the course and also increase the age of the man to that of Methuselah. I want to relate a little experience; I fell upon it acidentally. On one occasion I had been appointed as a delegate to visit a meeting in a country town. In order not to lose any time I concluded that I would wait until the preliminaries of the meeting were over. I missed my calculations, however, and got into the town on the morning previous to the preliminaries and had all day on my hands with nothing to do. But I learned that there was a dentist there of some renown, and I was fortunate enough to find him at his office. In the course of our conversation I learned that he had been a steel-worker in the Confederate army, and he showed me some instruments that he had made. In an hour and a half or two hours' time he went through all the clinical demonstrations to me that afforded me the means of making, pointing and tempering my instruments that I have handed down to my students, and that has been of infinite value to me. I have been taught by our worthy Professor Wildman how to go through the elaborate working and tempering of steel, but he speaks of water tempering. This other gentleman taught me how to take an ordinary piece of steel, to note the difference between a good and bad piece, to draw the temper, to shape my instrument and instantly temper that instrument in wax. By heating to a cherry red and plunging into beeswax you have the identical same advantage from point to shank that you can get from the elaborate training. I give a course during the term of an hour or two hours on the subject of the preparation of instruments, emergency instruments, as you might say. Of course, the dental men furnish us with all the instruments necessary, but there are times when, if

d get just what we wanted, properly shaped, we
much better work. A few minutes in the labora-
l it will be accomplished. As for a plugger, when
to do a piece of exquisite work, I temper the steel
ak it off, and I have the grain of the steel for my
ns, and the work may be done beautifully.
echnic that we want is to furnish within the limited
ose things which we can best do. We don't want
ke the fellow was who went into a hotel, and when
the menu he thought the whole thing was for him.
ve want to do is to take enough to drill us in that
lation in order that our fingers may become ac-
d, that we may have the confidence and ability to
hat we can by certain procedures accomplish the
hand. Fill a student's mind with confidence! let
ow that he can accomplish certain results; then we
ccomplished our ends. If the students could just
and sometimes "skip to dessert," I think they
e pleased.

W. C. Barrett of Buffalo: I would like to say a
r two because I have learned something to-day.
I first studied dentistry there was no such profusion
uments as there is to-day. I was obliged then, with-
training, to fashion certain instruments for myself
l it. I never could do it satisfactorily, and when
tal depots furnished everything that could be needed
loned trying to do any of that work. But when I
have more especially to do with the teaching of
s it seemed to me that they should be trained to do
ich I had never been able to accomplish myself.
Dr. Snow has had a thorough training in mechanics.
spent time in machine shops and has gone through
ugh, complete course of training; so I told him that
d him to map out a course of study in steel technics
class. He said, "All right," and he did. But I

thought he had not put very much into that course, and I talked to him about it, and he said: "Well, I think that is about all that is necessary." I never agreed with him until to-day, and now I acknowledge my mistake. I am satisfied, from the discussion that has brought out so many new ideas to me that Dr. Snow is giving as much as is wise or judicious to give to the students, and further, that the attempt to go into the manufacture of instruments that can be obtained at so cheap a rate at the dental depots, and much better than we can make, is a waste of time. If we had a ten-years' course, then I would be in favor of a complete course in steel technics; until that time I am satisfied that Dr. Snow, in this one intsance, is perhaps nearer right than I was, and I am perfectly willing to acknowledge the corn. I must say that I am quite in sympathy with Dr. Patterson, for once in his life, and am ready to applaud for once pretty much everything that he has said. Of course, I must make a little allowance for the Patterson of it, but I am inclined to think that he is very nearly right in this thing.

Now, Dr. Black gives us a beautiful vivid picture of a skillful mechanic who was able to shoot down a flag. We are not engaged in that kind of business. If we are to serve as gunners in a navy, we should undoubtedly go through a machine-shop experience. We can develop our manual digital dexterity in better ways than by the use of an extensive course of steel technics; and yet, I believe that every student should be taught something of the good qualities of an instrument so that he can be able to tell a good instrument from a poor one, but when it comes to making instruments, I must say that I have seen a great light to-day and I think that I must change my opinion, and that I will indorse Dr. Snow's course in the Buffalo school.

Dr. Watling of Ann Arbor. I hardly agree with Dr. Barrett in his assertion about instruments. I find that I

make a better excavator than I can buy. There isn't ...ent hatchet excavator in the market to-day; you can't ... them. They look to me in about the same condition ... my excavators look when I throw them aside ready for ...nting. They are short, they are too heavy, the edges ...rought down to the edge that we have in a cold chisel; ... are intended for splitting heavy material, not for that ...ate cutting that we want to do, and the only way I can ... instrument that will do that work properly is to make ...yself. Then, again, we may make a pattern just as ...as you please and take it to the manufacturer, and in ... short time we find that the manufacturer has dropped ...e thinks that an eighth of an inch variation doesn't ... much difference. I had some foil carriers made. My ...of a pair of foil carriers is that the points should be ...fine and should not open more than a quarter of an ... Well, you can't get them made in that way now; ...are invariably making them open an inch. In that ...t I say every student ought to know how to make ...things, and if he is dissatisfied with the way they are ... he can take a little time and make his own instru... and have them to suit him. It is not a matter of ... I would willingly pay for my excavators if I could ...em.

...man came to me three or four years ago and said he ... like to get the privilege of selling excavators to the ...nts. "Well," I said, "I have no objection to your sell...e students instruments, and I will recommend your ...ators, provided they suit me." He brought them out ... said to him: "These excavators were very good be... they were used up; they are just in the condition now ...ave some points put on them." He didn't feel very ...h complimented, and the result was that he didn't sell ... instruments. You can not depend upon manufactur...; they get careless; the workmen are not practical den-

tists, and the result is that we have very imperfectly made instruments.

Dr. J. Taft, Cincinnati: This is a very interesting subject, indeed, and I am rather surprised that such a variety of opinions are expressed. I am sure that every dentist would be better equipped for his manipulation in filling teeth if he knew how to form and temper these excavators. Very frequently you will find cases that require peculiar instruments for the proper approach to and proper manipulation in the cavity. Instruments are not perfect, because no instrument maker that I know of is himself a practical tooth filler, and he doesn't know what is wanted, only as he has been told by one and another. One dentist will show him a certain instrument and he may for a time imitate that; another will show him a different one and he will try to make his instrument conform to that, and he will have directions from a dozen different men all differing one from the other. How does he know what is best for the average operator? And he knows nothing about these extra cases, where special instruments are required. The practicing dentist, and he alone, can adapt instruments for these extra cases, and therefore the dentist should himself know how to form the point, and how to temper it so it will work well. Some excavators are tempered too hard; many are tempered too soft. You have all found this. But you will find occasionally one who is familiar with the methods of forming and tempering his own instruments, giving them the proper shape to have the best strength and the temper to have the best strength. You will use such instruments many times, not for months, but for years. I often have excavators in my case that have outlived numbers of other instruments. How is it? They are used just the same as the others, perhaps with more vigor than the others. And they are usually instruments that I have formed myself and tempered, or have had done by other dentists. Again, a great many

profession are out of the reach of manufactur-
nat is, for the time being. He breaks an instru-
, that is a necessary one for his operations, and he must send off hundreds of miles perhaps to get an instrument that will meet the case. I say this man ought to know how to prepare his own points, how to make them, shape them, temper them, and especially for special cases.

In what I have said I do not cast any slur on the manufacturers; they do the best they can. But I do think that wherever students are inclined to take to steel technics, as it is called, wherever they take a fancy to it, the time that is necessary has been greatly exaggerated here. It does not take a great deal of time to learn to repoint instruments, to learn to temper them and temper them right. It doesn't take a great deal of time to learn to forge steel. A few hours, days or weeks given to it will enable one to work steel in a very good degree. Now, it is an important thing to understand the quality of steel, as Dr. Black has emphasized; to know the different kinds of material you are using and to determine what particular kind of steel will give the best results, and the kind of manipulation to which it ought to be subjected to bring out that which will serve our purpose the best. I fancy that every man would like that kind of knowledge. He picks up a piece of steel, and he does not know what it is, and he works away on it and finds that the result is entirely faulty. Why? Because he was ignorant, and if he did know, he would either not use it at all or he would bring out better results.

Now, it seems to me that in our colleges there should be some instruction given in this direction; at least, every student should be able to repoint and temper his own instruments; and those students who take a fancy to this kind of work I should be in favor of encouraging and helping them in it. Dr. Watling took up the working of steel in his boyhood days. I know how he began. He didn't spend

any great amount of his time working steel, but he came to that point where he could make an instrument that would serve his purpose better than any instrument he could buy, and any student that will take a fancy to this kind of work can do the same thing.

Dr. W. C. Barrett: I would like to ask Dr. Taft a question. Do you think it practical, within the limits of the dental course, for the average student or any special student to obtain that special degree of skill to make a better instrument than the man who does nothing else?

Dr. Taft: I am sure they can. I have had this matter under observation for forty years and I know it can be done, and without encroaching a great deal upon the time of the student. His other studies will not suffer from that; indeed, it will be a rest for him.

Dr. T. W. Brophy of Chicago: I do not rise to discuss this paper, but from the beginning of the session of this body I have noticed among us an earnest listener; a man who is not a member, but one who was interested in the good work of our profession before many of us were born. I hope that you will call upon him for a word or two so that the young men in the profession may have a chance to see him. I refer to Dr. Leslie of Cincinnati.

Dr. Leslie of Cincinnati: The subject has been one of very great interest, and for myself I certainly feel disposed to indorse the remarks that have been made by Profs. Watling, Taft and Black. I have never had any particular experience in the working of steel, and yet I have been associated with some men who were excellent workers, and men whose instruments fifty years ago commanded respect. We had one man here in the city by the name of Sherwood, who could make a fine instrument. But so far as regards the subject of education, I feel for myself that there is nothing more desirable than for our students to become

acquainted with the knowledge that has been spoken of to-day. I remember very well that it was a point to which my father used to give a great deal of attention. I have seen him work at night many a time over an excavator to get it properly tempered; and I remember how delighted he used to be when he had one that he felt, as he used to say, would cut and would remain in such condition that it would continue to cut. But I hardly think it worth while for me to take up the attention of the gentlemen present. I can not help but indorse what I have heard, and, while it may perhaps seem to many that it is a waste of time, yet I agree with the gentleman who has said that it is not so much a waste of time as might be supposed. But I can tell you one thing that is often the case. There are times that occur when it is a great thing for a man to have a certain kind of knowledge. It is often the case that a certain kind of knowledge in any particular department enables a man to do things that he otherwise would not be able to do. The simple knowledge that he has gives him power and gives him advantage. And so I think it is, especially with those men who may be far away and who realize the difficulty of getting just such an instrument as they want. If any of you gentlemen should happen to be practicing in some of the distant islands of the sea, how glad you would be if you knew that you had the knowledge and the power to make an instrument. You would bless the college that you were educated in for being able to give you instruction in these matters while you were there. That is the way that we are able to appreciate these things sometimes; things that some other men might seem to consider as small because they can buy an instrument for twenty or thirty cents. It is the way we look at things. It is well for each of us to realize that there are conditions in life in which some of these things that are spoken of lightly are of immense advantage. Therefore, I hope that this department

of the subject of dental technics will be an active part of the teaching to students.

Dr. J. Taft of Cincinnati: I want just one more word which I overlooked before. It is simply this, that I can enumerate in this State and over the different States of the country some of the best operators in the profession in this or any other country who are eminently qualified in the manufacture of instruments such as I have been talking about. I could mention numbers in this State and many more outside of the State who are acknowledged to be superior operators, and they are just as superior in this department.

Dr. G. H. Wilson: I thank you for the consideration you have given this paper, and I will say to the gentleman who opened the discussion that he hit upon the reason why he was put upon the program to discuss this paper. He was known to be opposed to steel technics in general and he has certainly been the means of bringing out the discussion which was expected of him. Being a man from Ohio, we know that he is a truthful man, and when he says that he can not make a good instrument, we are perfectly willing to believe it. But, nevertheless, I am afraid that we are getting a little too much mixed; that is, a portion of us feel that the didactic teaching is the one great essential in the teaching of dentistry; the other portion feels that the technic work is the one great essential. When we get the happy medium and have the two nicely blended, then we have the ideal. It seems to me I can see that spirit with us; one is crowding upon the other. Technic work was never intended for that at all. I feel that our didactic teacher should not be so envious of the technic work, because we do not want the technic teaching to take the place of the didactic teaching. The professors of these different departments should carry on the work just the same as they did

before. And if we can stop every student in the college from smoking by hard work I shall say amen to it; although that would be rather difficult owing to the fact that so many of our leading men in the profession set the example for them. I want to call attention to one remark more which the President made. If we had gone on to the idea of describing the different kinds of steel, we would have encroached upon the professor of that department.

TEACHING CAVITY PREPARATION.

C. N. JOHNSON, L. D. S., D. D. S., CHICAGO.

As a preface to this paper, it may be briefly stated that really the best method of teaching cavity preparation is one which, with our present conditions, is wholly impracticable. To teach cavity preparation to the greatest advantage we must first suppose a teacher who is himself an expert operator, and with the ability to impart his knowledge to others. Then he must take the student to the chair, and show him a certain cavity in a tooth, which he must prepare in the presence of the student, with a running comment on his work, and the reasons why he pursues each line of procedure. This should be done with all classes of cavities of varying extent. Then the student should take the instrument and follow out a similar line of work under the direct supervision of the teacher, who should remain constantly at his elbow to correct any misdirected efforts, and make timely suggestions for improvement. This, with a continual cultivation and development of the student's judgment as to decisions in unusual cases, would round out a reasonably effective course of teaching cavity preparation.

But our present abnormally-sized classes, and our limited teaching material of the right sort, would seem to ren-

der such a system entirely visionary. The nearest we can come to it is to give in the lecture room and in the technic room the most definite and systematic instruction in the principles of cavity formation, and then supplement this with such demonstration as we can secure in the infirmary.

The purpose of the present paper is to treat only of cavity teaching in the lecture room, leaving for others more competent the consideration of the question from the point of view of the technic room and infirmary.

To lecture to an average class successfully requires several things. First, the lecturer must be a natural teacher —one with the instructive instinct. He must learn to be vivid in his descriptions and be quick to detect any lapse on the part of his class either in attention or understanding. He must be magnetic enough to hold his entire class as one man, and to this end must possess the ready wit to vary the nature of his discourse whenever occasion requires. For instance, if he detects in his class or in any member of it the slightest lack of interest, he must be prepared to suddenly change the order of his descriptions so as to instantly rivet attention to what he is saying. He must be apt in illustration, so that in describing any particular thing his word-painting will carry the idea vividly to the mind of the student. He must be seriously in earnest, and have a high appreciation of the responsibility resting upon him in his relation the young men entering the profession. He must weigh well his words, to the end that false doctrine be not spread broadcast as the result of his teaching. There is one thing he must not do. He must not go before his class with a cut-and-dried dissertation presented in a formal and perfunctory manner, as if he were preaching a prepared sermon. The day of set and solemn lecturing is past. If the teacher wishes to accomplish the greatest good for his class, he must put the very breath of life in his work, and in doing this must have diversity of method in presenting

the subject. He must repeat the same idea in several different ways to be assured that it is perfectly understood by all. A lecture which would read well in print is not the most effective for class work. The teacher should aim to impart to the students his ideas and not his words, so that they may gain an intelligent comprehension of the essence of the matter rather than acquire a parrot-like repetition. In short, he should compel them to think.

In lecturing on cavity preparation the necessary adjuncts relate to charts, drawings and models, and these should be supplemented as occasion demands by blackboard illustration made off-hand by the lecturer before the class. If he can not illustrate in this way, he would better learn how.

The first thing to make prominent before the mind of the student in teaching the preparation of any cavity is the marginal outline. This can ordinarily best be done with drawings hung prominently before the class. It has seemed to the essayist that the most vivid presentation of this feature is gained by making a picture of a certain surface of the tooth under consideration, with a typical cavity of decay indicated upon it. Then let the lecturer raise the question as to what caused this tooth to decay in this particular locality, and go on to a consideration of the general subject of the location of caries on the different surfaces. The teacher should arrest the attention of the student at every point possible to make him reason from cause to effect. Then upon the drawing he may indicate the points most susceptible to a recurrence of decay around such a filling, and show the proper marginal outline to prevent this recurrence. This fixes in the mind of the student an intelligent conception of extension for prevention. He must be given a clear idea of the reasons why decay recurs at the points indicated, and to this end he should be directed to study the anatomical relations of these parts in the mouth. In fact, he should frequently be referred to the mouth for observa-

tion in corroboration of any line of procedure suggested, so that the teaching of the lecture room may have as largely as possible a practical bearing.

When the marginal outline is understood, attention should be directed to the formation of the cavity walls for anchorage. At this point models should be largely substituted for drawings. They should be of sufficient size for the class to see them, and yet not so unwieldy as to prevent ready handling. Typical cavities should be cut in them and the form of each cavity wall taken up in detail.

In this connection it is well for the teacher to note the fact that he is expected to accomplish two things for his class. He must vividly imprint on their minds the exact form of these walls—this must be firmly fixed with each member of the class. But that is not all. The student must not only have an intelligent idea of cavity forms, but he must be taught how to describe them to the minutest detail in clear-cut, definite terms. Some students are quick to comprehend verbal descriptions, and to apply them to models and to teeth, and they are also apt in describing cavity forms themselves, so that they are intelligible to others. But a very large per cent. of those we are called upon to teach require iteration and reiteration in order to understand a given thing themselves, and then they need special instruction to qualify them to describe it so that others may understand it.

In a somewhat close study of the effects of various methods of teaching cavity formation to students, it has seemed to the essayist that the best results for the average heterogeneous class are to be obtained by a course something like the following—if the Association will pardon so minute and pedagogical a statement of method:

Having the model with the prepared cavity held before the class, the teacher points to the wall under considera-

tion, say the gingival (or cervical) wall of an occluso-proximal cavity in an upper bicuspid, and says: "This wall should be formed at right angles with the long axis of the tooth. It should be made horizontal bucco-lingually and mesio-distally so as to present a flat base for the filling to rest upon." Then, turning from the model and riveting the attention of the class by some appropriate gesture, the teacher should restate the matter in another and more descriptive form, ignoring the model entirely and using slow, definite and forceful language, somewhat like this: "The cervical wall of an occluso-proximal cavity in an upper bicuspid should be formed at right angles, etc." Then give the reasons.

This plan of procedure accomplishes several things. The first act of pointing to the cervical wall in the model definitely locates in the mind of the dullest student the precise wall under consideration. It does it at once, without any possibility of mistake, and without the necessity for him to take any time to locate the wall from verbal description. All students should, of course, be taught to locate precisely any point of a given cavity from verbal description, but all students are not able to do it with sufficient readiness at the outset to make it judicious to ignore models in this connection. If a student is obliged to pause, even for an instant, to locate a wall mentioned by the lecturer, he is practically lost, so far as that description is concerned, because the lecturer is well into the description before the student gets his bearings. With the wall pointed out to him, he is at once free to follow every word of the description.

Then the first statement of this description practically repeats the same idea in three different ways. The wall should be "at right angles with the long axis of the tooth," it should be "horizontal," and it should have a "flat base." This matter of repeating the same idea several times in different language has seemed to the essayist to be of very

great importance in lecturing to a large class of students of varying intellects and varying degrees of perception. What one student will grasp in one form may be entirely blank to another, while a different statement of the same idea might be illy understood by the first one, and readily caught by the second. It is seldom that a single statement, no matter how definitely made, will be equally interpreted by all. At least, it will not be so interpreted at that particular moment. If we wished to teach by rule of thumb whereby the lecturer should make a certain statement and have the class copy it in their note-books, to be subsequently learned by rote, then a single wording of that statement might do, but this is precisely what we do not want. Above all things we must avoid making parrots of our boys. We must make of them reasoning, thinking, logical human beings, and in order to do this we must get at their understanding and force the idea of the thing clearly into their minds before we concern ourselves much with the wording as it relates to their point of view.

And yet the wording from their point of view is a very important matter. As has just been stated, a student must not only be taught a thing, but must know how to describe it in clear and unmistakable language. This is why it is advised to turn away from the model after a clear conception of the form of the cavity wall has been imprinted on the minds of the class, and give a comprehensive description in slow, measured phraseology, as if the model were not at hand for illustration. The teacher must watch his class carefully and study the varying expressions of countenance presented to him, so that he may be able to determine accurately whether or not he is being fully understood by all. If his quick perception shows him that there is the possibility of the slightest confusion in the mind of any member of the class as to a perfect comprehension of the points just made, he should not hesitate to repeat in slow,

measured tones that part of the description which may seem necessary to clear it up, and if he is still in doubt, it is often well to pause in the lecture and make a request that questions be asked the lecturer on any points not perfectly understood. These questions on the part of members of the class often lead to a clearer elucidation of the points under discussion than would have been possible without them.

If each wall of each cavity be taken up in this detailed manner, and then a clear idea given of the relation of the different walls one to the other, it will eventually give a reasonably adequate understanding of general cavity formation. This matter of calling attention to the relation of one wall to another is important. It seems at once to fix in the mind of the student not only the direction of the different walls and the general form of the cavity, but also gives a clear idea of anchorage.

As to the best method of stating this relationship between walls, it has seemed to the essayist in recent years that the readiest comprehension on the part of the student was gained by a quite general use of the term "angle." This term appears to carry to the mind of the average listener a more definite understanding than any other form of descriptive wording. If we say to a student that the cervical wall should join the axial wall at right angles, he seems instantly to grasp the idea, and it also carries with it something of the form of the cavity in that region. We may use the terms "right angle," "acute angle," or "obtuse angle," if the case should require, and if perchance we do not believe in angles at all between walls, we may say that instead of such and such a wall joining another at a right angle, it should join it on a short curve or a gradual curve. The fact of mentioning an angle seems to convey a vivid picture to the mind, and in the experience of the essayist, at least, it has proved of the greatest utility in cavity description.

When the cavity walls are described and the problem of anchorage thereby adequately considered, the question of the enamel margins must be taken up and treated in the same detailed manner—with the reasons for the particular form advised.

The student now should know what the finished product is to be, but what he does not know is how to produce it. In other words, he does not understand the technique, and this is the next, and final, step in teaching cavity preparation. The lecturer should go back to the formation of the marginal outlines and give different methods of instrumentation for extending cavities, for forming walls, and for preparing enamel margins.

This question of technique is one of the most difficult phases of the whole subject to deal with. The reason for this lies in the fact that the matter of personal equation enters so largely into its practical application. The most—or, rather, the best—that a lecturer can do, is to give several methods of doing the same thing, with the pros and cons of each method. It will scarcely do to stand before a class of students and outline any one method and say to them that this method shall be followed in all cases. No operator in practice can invariably follow any one method to the exclusion of others, and do his patients justice. It is true the teaching of the past has been faulty because of the fact that for the most part little attempt has been made to formulate any method. The student has thus been left to his own resources, with the inevitable result that he has approached his work in a haphazard, indefinite manner, wholly devoid of system. The idea of system must be impressed upon the class, to the end that even if the students can not find it in their fingers to follow the methods taught by the teacher, they will at least formulate some method and pursue their work systematically.

One last office remains in the teaching of cavity preparation. It is supposed that the lecturer has given his students the form of cavity in the different classes which, to his mind, is the nearest possible to the ideal. It would be well were it feasible always to attain the ideal in practice, but unfortunately this can not be done, and unless this fact is made prominent to the student, he is certain to encounter a grievous disappointment when he approaches a patient to carry out the teachings of the lecture room. Nothing will sooner tend to undermine the confidence of a student in his teacher than to find his methods incapable of practical application in any large per cent. of cases presented for his early operations. A student can not be expected to so control his patient as to be able to accomplish ideal results in anything like the number of cases that an experienced practitioner can, and all of these considerations must be made clear in order to send the student to his work with an intelligent conception, not only of his possibilities, but of his limitations as well. The ideal should be held before him at all times as something to strive for, and he must be taught not to content himself with anything short of the ideal, unless for good and sufficient reasons. But to neglect to tell him that the ideal can not always be attained is to invite a subsequent distrust which will seriously jeopardize the teacher's influence.

Dr. W. E. Harper of Chicago: I have very little to say in regard to this paper, in view of the fact that I practically and entirely agree with the essayist. There is just possibly one suggestion that I could make that will facilitate the ability of the student to both understand the teacher better and also to make himself understood by others. A plan adopted at our institution has been, after lecturing or directing in the preparation of any particular cavity, the student is called upon to prepare such a cavity in the infirmary, and he is directed that in the preparation of the cavity and

in the filling he must give, after the operation is completed, a written description of the entire operation which shall include the methods of procedure, the instruments used and the order in which the different procedures were adopted, and the different order in which the instruments were used. The first effort of the student, to be sure, is usually not a very creditable one, but you will find that he will establish the habit of making comparisons with his classmates, and, after two or three written descriptions of anything like a complicated cavity, his efforts will be fairly creditable, and efforts that I think possibly can not be developed in any other direction. Now, that enables him not only to better understand his teacher in the directions that he may give, but it enables him better to impart the knowledge that he has gained to others, both during his college career and afterward. I disagree with the essayist in one point, when he comes to the consideration of instrumentation. I think too much stress is placed upon this personal equation. I look upon much of this difference in individuality to be from lack of proper methods and instruments best adapted to the purpose. I believe there is a best way to accomplish any particular operation or part of an operation. I don't believe that there are six or ten ways that are equal. And I believe, with a well-selected list of instruments, covering a reasonable range of form and size, constructed on mechanical principles, that we can build up practically a uniform method for the preparation of cavities and for filling. I know it is not possible to do it with those of long experience, but with the young men a method of instruction having that end in view can be adopted which, I think, will accomplish this. For instance, in instrumentation; I don't think it is wise to tell a student a half dozen different ways to an operation. My judgment is that it is the duty of the teacher to select what is in his judgment the best; give them that one and give it thoroughly, and let them know, at

least, one way of doing it, and the student can individualize afterwards and select other methods and adopt them if they are better adapted to his particular ability. So I would differ simply on that point. Otherwise I would agree with the essayist. I had hoped that the presentation of the paper would lead to a discussion as to the relative value of different methods of presenting this subject which would have been of a little more interest, to me at least. I would like to know whether I spend too much time in the technic department in this work, and whether I spend insufficient time in the lecture room. I would like to decide with a great deal of certainty how much I shall do in each, and in which I can accomplish the best results in the shortest time.

Dr. H. W. Morgan of Nashville: Like Dr. Harper, I agree so heartily with what has been said by the essayist that I can do nothing more than look at it from the standpoint of the teacher. As a teacher of cavity preparation, the subject is one that has presented many difficulties to me, and, while I have pursued, in a large measure, the course outlined by the essayist, there are some things that I think he might have emphasized that have not been touched upon. In looking at Dr. Brown's chart, down the line of dental anatomy, I think I can account somewhat for the difficulty that the students have of making themselves understood in the description of cavity preparation. I do not understand how a man can make himself clearly understood so long as we have such a diversified nomenclature. Dental anatomy should occupy a place in the first year which should be emphasized and exercised and drilled more thoroughly. When we have done this, the names of the surfaces of the teeth have been thoroughly learned; then a scientific description of cavity preparation becomes a matter very simple and very easy. Take the method as followed by some, of naming the cavity from the surface upon which it is found,

which when first presented seemed like some foreign lingo that we could never get into our heads, and yet how simple it becomes after it is thoroughly understood. The extension of a cavity gingivally or linguo-gingivally, or linguo-distally, at first, and to the students particularly, seemed to be a presentation of the subject in such a puzzle that it could never be unraveled; and yet, now it is as plain as day, and instead of wanting for attention you have the fixed attention of the students. This omission of a thorough course in dental anatomy accounts for much of the lack of interest that Dr. Johnson has alluded to. And then, again, I do not think that most of us give a sufficient amount of time to dental histology. By all means it comes in the first year and should be thoroughly drilled with the idea that this histology prepares you to meet the conditions when you come to the preparation of cavities. This has been very fairly outlined in the paper and it is not necessary for me to stop to explain what I mean by meeting the conditions. When you present to the student the conditions and teach him the reason of extension for prevention; when he understands these, then the matter is all very clear and there is no difficulty in getting his attention. In the course pursued by us we undertake to do this work in a three-fold form. First, operative technics is under the direction of a teacher who is in thorough harmony and accordance with the professor of operative dentistry, and the same principles that emanate from the lecture platform are those which are thoroughly instructed and drilled in in the laboratory. Again, in the infirmary, the necessity for the teacher of operative dentistry to stand over the chair and give the ideal course as pictured by Dr. Johnson is taken advantage of in that the demonstrators are selected from the graduates of the school who are qualified to give this instruction. We think we meet it this way in a three-fold form. I felt this morning, when Dr. Whitslar gave us the new term for the infirmary, like substituting still another, and calling it oc-

culatory, where we admit in the afternoon the junior students to have an occular demonstration of what they have been learning in the technic room in the morning. In addition to the charts and models and free-hand drawings, as alluded to by Dr. Johnson, we take advantage of a still further adjunct and use an electric projection lantern. In this way we get in a magnified form many cuts and many diversified forms of cavities which enables us to give better instruction than we think it is possible to do with a chart or with a model. The large models that have been used have their purpose, and for this purpose they accomplish very much good, but in large classes more than half of the class do not get the contact with it that they can with a picture upon the screen. We make inroads upon the various addresses and journals, and as soon as a new cut comes out we take advantage of it, and in some instances have drawings made for particular purposes and present them through the means of the lantern. The doctor has alluded to the establishment of an ideal. There is not before me an operator of ten years' standing who has not many times passed his ideal. While the ideal is something to be struggled for, it is something that is continually changing. No man's ideal is the same to-day that it was yesterday. And it is this contact of the first and second year students with the finished work of the third-year men that establishes an ideal, and for this reason we feel that it is not proper and right to exclude the first year men from any opportunity of advantage in the infirmary. I agree most heartily with Dr. Weeks's definition this morning as to the purpose of an infirmary, but I would pity the student who is denied any privilege in the infirmary until his last year.

Dr. G. V. Black of Chicago: It is pretty difficult to arrive at our conception of the teaching of this or that subject practically. Now I should say that in teaching cavity preparation the student must be prepared in the lecture room.

First in the technic course he should be taught to outline typical cavities, the various forms of typical cavities, and in this teaching he should be taught cavity nomenclature, so that he will be enabled to know just what is meant when words are used descriptive of those cavities. No matter where that cavity may be located, he will be able, from his nomenclature, to know the particular forms of the individual walls, of the individual angles, of the individual parts of that cavity. He is then ready to go to the lecture room, and is not ready before. You can not talk to a man about cavity preparation who does not know the nomenclature of cavity forms. He should, at the same time that he is learning these cavity forms, look into the instrument forms. He should be able to read his instrument points and know them. Then, when he goes to the lecture room, the lecturer may say, "Form the lingual wall of such and such a cavity with such and such an instrument, or with hatchet 20-9-12, or with hatchet 15-8-12," and so on. Then in the junior year he should be taught cavity preparation as it occurs in the mouth. This can be pursued in the lecture room in the junior year in this way. Then in the clinic room the students are divided into sections, each section with its demonstrator or demonstrators; and the demonstrator receives his instructions from the professor of operative dentistry, and this is put into actual practice in these directions in the infirmary. In this double way the student becomes familiar with the preparation of cavities, the instruments he should use, and develops his manipulative ability along this line. Then, in the third year, the effort should be along the lines of bacteriology, the causes and nature of caries and those processes in the formation of cavities necessary to arrest caries. Here we come to the philosophy of filling teeth as the last subject to be taught the student. He is taught the how first, and then the how under the conditions, and then the philosophy of the whole procedure later.

TECHNIC METHODS IN TOOTH OCCLUSION, ETC.

I. NORMAN BROOMELL, D. D. S., PHILADELPHIA.

In this brief paper I shall attempt to describe a special method in manipulative procedure which has met with much favor and been productive of many good results in the prosthetic department of the Pennsylvania College of Dental Surgery. While the supervision of the work is given to this department, it could with equal propriety be included under the head of dental anatomy, having as its chief object to familiarize the student with tooth types, tooth forms, tooth arrangement, occlusion, etc.

The method is as follows, and is taken up during the first and second years: Each student is provided with two tin models, one of which represents the superior and the other the inferior teeth, with their surrounding tissues. These models are reproduced from mouths presenting favorable and typical conditions, and from them the student is obliged to make duplicates in plaster and mount the same on an articulator; and when thus equipped he is prepared to continue his work. He is next provided with a complete set of metal tooth molds, and by the aid of these, fourteen plaster teeth are produced. While the teeth thus furnished are necessarily more or less crude and of greater bulk than desired, they nevertheless possess a contour which in general corresponds to the teeth on the plaster models previously mentioned.

It is the custom for each student to mold two or three set of these plaster teeth while having the metal molds in his possession, for in the subsequent work he is expected to carve them to a form and size corresponding to those upon his plaster models; in fact, the whole object is to reproduce these, with all their anatomical detail, by shaping and mounting the individual plaster teeth upon a base of paraffin and wax.

Tin models are next furnished representing the mouth of an edentulous patient; from these plaster impressions and casts are secured, base plates adapted to each, and, after the adaptation of wax contour guides, the casts are mounted in an articulator. To prepare the plaster teeth for carving and shaping to their final contour, they are submitted to a bath of paraffin, and as this proceeding is one that may be used for the preservation and embellishment of plaster of paris models in general, the details of the work will be given. The individual teeth are first dehydrated by baking in a moderate oven, and are next transferred to a saturated solution of borax and water, and in this way they are boiled sufficiently long to insure the thorough penetration of the mixture. After removal from this bath the teeth are again returned to the oven and completely dried out, thus preparing them for the ready absorption of the paraffin. The final bath is next prepared by melting the paraffin in a suitable vessel surrounded by boiling water, and in this the teeth are allowed to remain for about fifteen minutes. After removal, the quality of the plaster is completely changed, and we find a toughened mass, capable of being carved or cut with the greatest precision, and with little or no inclination to fracture. The work of carving the teeth is performed as they are in turn placed in position on the wax base plate, and it is from this that the greatest benefit is derived.

The pattern models furnished are selected with the idea of including a complete variety in tooth form and occlusion, and sufficient time is devoted to each type to infuse into the student's mind the relationship existing between the two.

The superior incisors are first taken up and carved to represent a certain type, the general size and form of the crown, the characteristic convexity of the labial surface, together with the general concavity necessary upon the pal-

atal surface to accommodate the incisive margins of the opposing teeth, all receiving due consideration. The inferior incisors are next treated in the same manner, the mesiodistal measurement of the crowns as compared with the same measurement of the superior incisors being one of the valuable points brought out at this stage of the work. The cuspids are next dealt with, and if an error exists as to the transverse measurement of any of the incisors already in position, it will now assert itself, and the student is at once compelled to investigate, much to his own profit. In the manipulation of the bicuspids, beside the direct anatomical study presented by carving, the relative size of the superior and inferior teeth is forcibly brought out, the nature of the occlusion as already established by the anterior teeth suggests itself, and again the student profiteth much. The same technic methods are employed when the molars are taken up, the relative size of the crowns, the length of the cusps, the relationship between the cusps of one tooth and the fossae of the opposing tooth, all being thoroughly impressed upon the mind of the student by the methods employed and persisted in. To sum up, we find included in this work dental anatomy, dental physiology and dental prosthesis, a clear conception of any one of which may be gained only by a thorough knowledge of all. Another method which contains many of the points contained in the process just described is as follows:

Each student is required during his freshman year to take impressions of the mouth of one of his classmates, one representing the upper and the other the lower dental arch, make a plaster cast of each, place them in occlusion, and from a careful study of their several characteristics, write out a brief description, including the tooth type, the gingival margins, the occlusion, etc., as indicated by or compared with the temperament of the individual.

In this work specially prepared impression trays are brought into service. These sectional trays are made in this form, composed, in some instances, of three separate parts, in others of four or five parts. In taking the impression, modeling composition is used and the work is begun by placing one of the sections in position, the proper one being determined by the conditions existing in the mouth. If the crowns of the teeth are strongly bell-shaped, and the interproximate spaces a predominating feature, one of the lateral halves is first forced in position. If undercuts are present from the loss of one or more teeth, that part of the work which best overcomes this complication is first accomplished. I have here the model of a mouth which will best demonstrate the method of procedure. After the various sections have been placed in the mouth and the impression material thoroughly hardened, they are removed one at a time, and when placed together form a reproduction free from the dragging or the general distortion so common to wax or composition impressions. In this work the student becomes familiar with the various complications and hindrances in impression taking; he is enabled by his own and the associate work of his classmates to appreciate the many anatomical variations present in the human mouth, all of which become more potent when recorded in a descriptive essay covering the same.

Owing to lack of time, the paper was not discussed.

OFFICERS OF THE NATIONAL SCHOOL OF DENTAL TECHNICS.

Organized at the World's Columbian Dental Congress, Chicago, 1893.

1893.—President, D. M. Cattell; Secretary, J. A. Dale; Committee on Constitution and By-Laws, T. E. Weeks, H. P. Carlton, J. A. Dale.

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Editorial

Zounds! I was never so bethump'd with words since I first call'd my brother's father dad.
—Shakespeare.

AN INNOVATION.

We present to our readers this month an innovation in dental journalism in the shape of the complete proceedings of the National School of Dental Technics at their last meeting. We do this for several reasons. In the first place, so far as we know, such a number was never before sent to subscribers by a dental journal, and we are always ready to try anything novel once. Our record proves that. Again, the National School of Dental Technics is one of the brightest, ablest bodies of dentists that meet, and their proceedings are full of interest. And, lastly, the matter printed this month should be attractive reading to every dentist in the country who has the best interests of his profession at heart. The profession at large really do not know what the *working* college men are doing, and the National School of Dental Technics is made up of the workers on the college faculties. No one can read this number of the JOURNAL without being impressed with the rapid strides that are being made in educational methods. Systems are being formulated, the good from many suggestions is being adopted and the bad sifted out and thrown away. "What to teach; when to teach it; how to teach it." Those are the lines upon which this body works. In the minds of those acquainted with the progress that has been made, there is no question about the value of its work. The National

School of Dental Technics is doing more good for the profession to-day than any other organized body in it. The work now being done will not show in its completeness for some years, as it is *foundation* work. But the minds and fingers of future generations of graduates will have its indelible imprint.

Society Announcements

Mark well the time and place.

INDIANA STATE DENTAL ASSOCIATION.

The Indiana State Dental Association meets at Terre Haute, Indiana, the last Tuesday in June, 1899.

ALEXANDER JAMESON, President.

J. S. M'CURDY, Sec'y, Fort Wayne, Ind.

INDIANAPOLIS ODONTOLOGICAL SOCIETY.

The Indianapolis Odontological Society meets at the Indiana Dental College on the third Tuesday in each month.

J. QUINCY BYRAM, Secretary.

ISAAC KNAPP DENTAL COTERIE OF FT. WAYNE, IND.

The Coterie meets at the office of some member on the second Thursday of each month.

NELLIE FRENCH, Secretary.

EVANSVILLE DENTAL SOCIETY.

The Evansville Dental Society meets at Evansville on the third Monday in each month.

C. CHANDLER GEORGE, Secretary.

EASTERN INDIANA DENTAL ASSOCIATION.

The Eastern Indiana Dental Association will meet at Marion, Ind., Wednesday and Thursday, May 3 and 4, 1899.

N. W. HIETT, Marion, President.

F. R. HENSHAW, Middletown, Sec'y.

CLEVELAND DENTAL SOCIETY.

The Cleveland Dental Society meets on the first Monday in each month, except July and August, at 5 p. m., in the parlors of the Hollenden House.

H. L. AMBLER, President.

G. N. WASSER, Secretary.

TOLEDO DENTAL SOCIETY.

The Toledo Dental Society meets on the second Friday of each month, at 5 p. m., in the parlors of the Boody House.

OHIO STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the Board of Examiners of the State of Ohio will be held in Columbus, O., Wednesday, May 31, 1899. All persons desiring to take the examination must make application to the Secretary before May 20. Address

L. P. BETHEL, Secretary,
Kent, Ohio.

IOWA STATE DENTAL SOCIETY.

The next meeting of the Iowa State Dental Society will be held in Des Moines, May 2, 3, 4 and 5, 1899.

WILLIAM GILMORE CLARK, Sec'y,
Cedar Rapids, Iowa.

NORTHERN OHIO DENTAL ASSOCIATION.

The Fortieth Annual Meeting of the Association will be held at Cleveland (Colonial Hotel), May 16, 17 and 18, 1899, beginning at 10 o'clock a. m., sharp, Tuesday, May 16th.

MISSOURI STATE DENTAL ASSOCIATION.

The thirty-fifth annual meeting of the Missouri State Dental Association will be held at Kansas City, Mo., July 11, 22, 13, 14, 1899. An interesting program will be presented.

Hotel and railroad rates have been secured.

All members of the profession are cordially invited to attend.

B. L. THORPE,
Corresponding Secretary,
St. Louis.

INDIANA STATE BOARD OF DENTAL EXAMINERS.

The Indiana State Board of Dental Examiners will conduct an examination in dentistry in the State House, commencing Tuesday, June 13, 1899, at 9 o'clock a. m., sharp. The number of the room in which the examination will be held may be learned from the custodian of the building.

Applicants must come prepared for a three or four days' session, at least two days of which will be devoted to practical work. Fee for this examination is $20.

Those interested should address the Secretary for further particulars.

M. A. MASON, D. D. S.,
Secretary Board of Examiners,
Fort Wayne, Ind.

KENTUCKY STATE DENTAL ASSOCIATION.

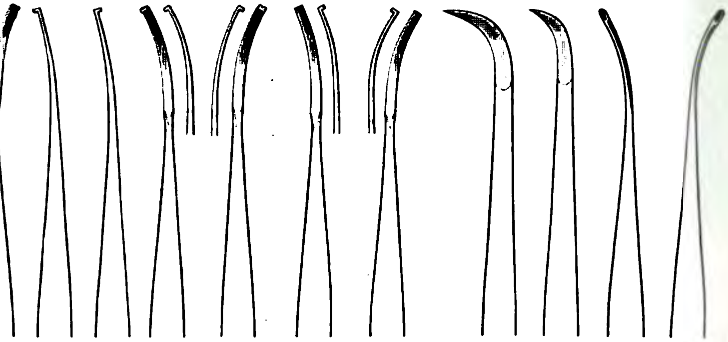
The twenty-ninth annual meeting of the Kentucky State Dental Association will be held at Mammoth Cave, Ky., May 16, 17 and 18, 1899. A cordial invitation is extended to all members of the profession to be present.

For information, address

J. H. BALDWIN,
Secretary,
307 West Broadway, Louisville, Ky.

SCALERS.

Devised by Dr. A. W. Harlan.



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Dr. Harlan writes this description of these Scalers:

"They are intended to remove fine deposits from the roots of all eeth and between the teeth.

"They should be used with a delicate push and pull movement.

"Nos. 1 and 2 are right and left push Scalers, Nos. 3 and 4 are lelicate reverse or pull instruments.

"Nos. 5, 6, 7 and 8 are right and left direct and reverse pull Scalers.

"These are especially useful where Nos. 3 and 4 will not reach.

"Nos. 9 and 10 are sickles, to be used between the teeth; they may pe used with a push or pull movement.

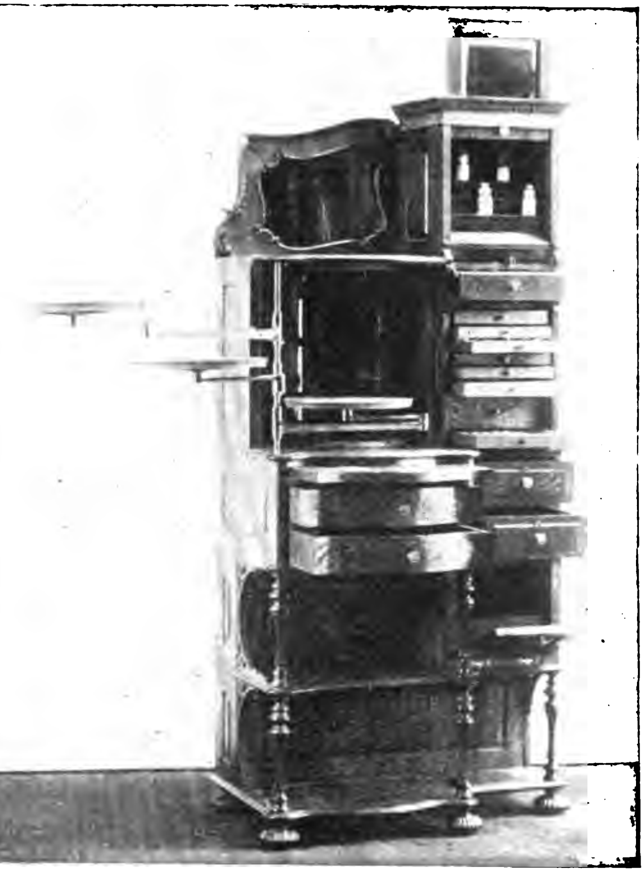
"Nos. 11 and 12 are delicate spoon pushing Scalers, for removing ine deposits from the bifurcations and otherwise inaccessible localities."

These instruments are not intended for the heavy work of removing salivary deposits, but for the finer operations for which they are especially designed they will be found indispensable.

Not kept in stock for Cone-Socket Handles.

Price..Each, $0.50
Price..Per Set, 6.00

. 65 DENTAL CABINET



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s one of our several patented designs of Dental Furniture for Operating
tracting Room and Laboratory.
rices and styles vary to suit the preferences and purses of our patrons.
abinet illustrated is full of conveniences, every drawer having a special

our dealer you want to see our line.
r circulars describing our Cabinets, Work Benches, etc.

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ARTIFICIAL TEETH.

Patented September 17, 1895,
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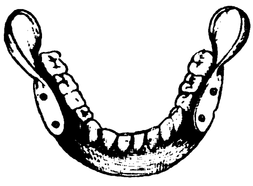

iners do what their name implies, they hold a lower plate firmly and steadily in while eating, singing, talking, public speaking, blowing a wind instrument, hold-ar, pipe, or a much heavier object between the teeth. The muscles of the jaws and n their contraction exert a pressure on the expanded and vertically extending of the retainers. This pressure, which is exerted without conscious effort, is the t holds the lower denture firmly in position on the alveolar ridge.
most skeptical in regard to the merits of this invention will be convinced by giving . Your patients will acknowledge the comfort and benefit derived therefrom before your office. Retainers are made of Gold, Platinum and Aluminum.

PRICES,	One Pair Aluminum,	-	$0.75
	Six Pairs Aluminum,	-	$4.00

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. H. M. CARROLL, 328 West Commerce St., San Antonio, Texas, U. S. A.

For filling teeth the best cement to use is Dr. Dawson's "PLASTIC PORCELAIN" CEMENT. It is very adhesive and seals the tubuli against bacteria-laden secretions. It practically becomes a part of the tooth. Its thorough insolubility prevents its dissolution by the secretions of the mouth, and it exhibits such a remarkable degree of hardness that it has been said to compare favorably in that respect to tooth substance itself. Being mixed thoroughly with its peculiar white porcelain-like paste instead of a watery liquid, it gives the hardest and most durable plug.

For attaching crowns, the glue-like adhesiveness and ease of manipulation that characterize the celebrated GERMAN FUSED OXIDE Cement render its superiority unquestionable. It is smooth, very easily worked, and does not crystallize.

Dentists can obtain both the "Plastic Porcelain" Cement and the German Fused Oxide from the home office of the Consolidated Dental Mfg. Co., 115 West 42d Street, New York; from its branch houses in Boston, Providence, Philadelphia, Brooklyn, Baltimore, Atlanta, Chicago and New Orleans, and from its numerous agencies throughout the United States and Canada.

The "Plastic Porcelain" Cement is sold in full size packages (containing two bottles of powder and one bottle of paste) for $2.00. It is also sold in packages at $1.50, and a sample package can be had for $1.00.

German Fused Oxide is furnished only in two-bottle packages, with choice of either yellow or grey powder, at the price of $1.00.

PROCEEDINGS

OF THE

SEVENTH ANNUAL MEETING

OF THE

nstitute of Dental Pedagogics.

(Formerly National School of Dental Technics.)

FOR THE YEAR 1899, PHILADELPHIA.

FOURTH VOLUME, PUBLISHED 1900.

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PREFATORY NOTICE.

N presenting this report of the proceedings of the seventh ual meeting, the Publication Committee has taken the liberty eporting only an abstract of the discussion had. In doing so e has been exercised that each speaker's ideas, and, so far as med wise, his language has been retained. The effort has been eliminate everything redundant or irrelevant, and it is hoped t all interested may feel that the committee has done all that s possible to put on record a fair statement of the proceedings, l with no intention to restrict or misinterpret any one.

THOMAS E. WEEKS,
HART J. GOSLEE,
NELVILLE S. HOFF.

PROGRAM

seventh annual meeting of the Institute of Dental Pedagogics
erly National School of Dental Technics), Philadelphia, Pa.,
ber 27, 28, and 29, 1899.

WEDNESDAY, 27th.

o A.M.—Preliminary organization, payment of dues, report
cutive officers, executive business.

o A.M.—Report of Committees on Syllabi. "Operative
ic," Dr. T. E. Weeks; "Prosthetic Technic," Dr. H. J.
.

o A.M.—President's address, Dr. N. S. Hoff. Discussion,
. C. Kirk and H. A. Smith.

P.M.—"Syllabus for Dental Curriculum," Dr. F. D. Weisse.
ssion, Drs. S. H. Guilford, M. W. Foster, and G. V. I.
.

P.M.—"Dental Pedagogics," Dr. A. E. Webster. Discus-
rs. C. N. Johnson, R. H. Hofheinz, and L. G. Noel.

P.M.—Address, "Manual Training," Prof. J. Liberty Tadd.

P.M.—"The Use of the Lantern in Teaching," Dr. M. H.

THURSDAY, 28th.

o A.M.—"Orthodontia Technic," Dr. C. S. Case. Discus-
rs. C. D. Lukins, Grant Molyneaux, and B. Holly Smith.

o A.M.—"Root Preparation Technic," Dr. H. J. Goslee.
ssion, Drs. I. N. Broomell, H. W. Morgan, and H. P. Carl-

P.M.—"The Use of the Blackboard in Technic," Dr. A. D.
an. Discussion, Drs. C. J. Essig and H. W. Arthur.

P.M.—"Operatory Methods," Dr. W. H. Whitslar. Discus-
rs. W. E. Wilmott and D. M. Cattell.

P.M.—Election of officers.

FRIDAY, 29th.

o A.M.—"The Use of Text-Books in Class Work," Dr. Otto
d. Discussion, Drs. G. E. Hunt and H. B. Tileston.

o A.M.—Symposium of fifteen-minute papers on our text-
: "Operative Dentistry," Dr. G. V. Black; "Prosthetic
stry," Dr. I. N. Broomell; "Dental Pathology," Dr. A. H.
pson; "Dental Therapeutics," Dr. J. Truman; "Oral Sur-
Dr. T. W. Brophy.

P.M.—Adjournment.

MINUTES.

Continental Hotel, Philadelphia, December 27, 1899.

e seventh annual meeting convened at 10.30 a.m., with the dent, Dr. N. S. Hoff, in the chair.

enty-three colleges were represented by delegates, and about were in attendance.

motion, the minutes of the sixth annual meeting were ap- d as printed in the proceedings.

erbal report of the Executive Board was made by the chair- Dr. G. H. Wilson, announcing the work of the board and itting the program. Upon motion, the report was accepted pproved.

ved that a vote of thanks be extended to the Local Com- e of Arrangements for aid in preparing program and arrang- r meeting. Carried.

e chair announced that the program had been slightly altered der to give Committees on Operative and Prosthetic Technics time to report, and that the president's address would be ext order of business.

e-President H. P. Carlton was called to the chair, and the dent delivered his address.

scussion was opened by Dr. E. C. Kirk, and continued by Drs. , Barrett, George Hunt, Weeks, and Brophy, then closed e essayist.

. Kirk then presented an invitation to hold the evening ses- at the University of Pennsylvania, on account of better facili- or lantern exhibits, and announced that luncheon would be d there preceding the session.

ved and carried that the same be accepted.

port of the Committee on Operative Technic Syllabus then nted by Dr. Weeks, followed by the report of the Committee rosthetic Technic Syllabus by Dr. Goslee.

Upon motion, both were approved and accepted.

Dr. Guilford then made the report of the Local Committee of Arrangements.

Motion to accept and approve carried.

Dr. Guilford then extended an invitation to the body to attend a theater party on Thursday evening, and to visit the Philadelphia Dental College some time during the day.

Upon motion, both invitations were accepted, and the latter was made a special order of business for 12.30 o'clock Thursday.

Adjourned.

2.30 P.M.

Meeting called to order by President Hoff.

Minutes of the previous session read and approved.

Moved by Dr. George Hunt that a committee of three be appointed to consider the president's address with a view to acting upon the suggestions made therein. Carried.

Chair appointed Hunt, Weeks, and Webster as a committee.

The following resolution was then offered by Dr. Hunt:

WHEREAS, Our time is limited and straight talking to the point has ever been characteristic of this body; and

WHEREAS, Dispatch is necessary for the transaction of our business; therefore,

Be it resolved, That no one shall occupy the floor more than once to speak on any subject until all who desire to speak have finished, and then only with the consent of the body; and be it further

Resolved, That no one shall occupy the floor in the discussion of any subject for more than five minutes, except he ask for and receive the unanimous consent of the house, in which case he may then occupy another five minutes only; and be it further

Resolved, That the chair is requested to time each speaker and vigorously enforce this rule. (Signed) GEORGE E. HUNT.

Resolution received and referred to Executive Board.

Report of Executive Board indorsing Dr. Hunt's resolution received, and upon motion approved.

In the absence of Dr. Weisse, who was unable to arrive in time, Dr. Webster read a paper on "Dental Pedagogics." Discussion was opened by Dr. C. N. Johnson and continued by Drs. Thompson, Smith, and Darby, and then closed by the essayist.

Dr. A. J. Gritman then read his paper on "The Use of the Blackboard in Technics."

the absence of Dr. Essig, the discussion was opened by Dr. . Arthur and continued by Drs. Hoff, Tenney, Whitslar, Bar- Vilson, Truman, Case, and Guilford, and then closed by the ist.

the request of the chair, Dr. Brophy then addressed the meet- 1 the advisability of the colleges representing this body mak- ome effort toward an exhibit of charts and technic work of ican dental colleges at the Paris Exposition.

ved by Dr. Taft that the matter be left in the hands of a com- appointed by the chair. Discussed and carried.

chair then named Brophy, Wilson, Morgan, and Hunt as a ittee, with instructions to report later.

secretary then announced an attendance of seventy-five, enting twenty-three colleges, of which seventeen had quali-

ourned.

6.30 P.M.

1cheon was served at the University of Pennsylvania, after Professor J. Liberty Tadd addressed the meeting on the t of "Manual Training," and Dr. M. H. Cryer on the "Use Lantern."

ourned.

THURSDAY, DECEMBER 28, 10.30 A.M.

eting called to order by the president.

utes of previous session were read and approved.

lication of Washington Dental College, of Washington, presented by Dr. W. W. Evans, read by the secretary, and ed to the Executive Board.

C. S. Case then read his paper on "Orthodontia Technics."

he absence of those on the program, Dr. H. A. Smith was upon to open the discussion, but declined.

eral discussion then followed, participated in by Drs. Weeks, n, Templeton, Guilford, Whitslar, Hoff, Goslee, Carlton, and then closed by the essayist.

ved to include paper on the subject presented by Dr. God- 1 the proceedings. Supported and carried.

I. N. Broomell then extended an invitation to visit the Penn- ia College of Dental Surgery, which was upon motion ac-

cepted, and made a special order of business for 9.30 o'clock Friday morning.

Adjourned.

2.30 P.M.

Meeting called to order, with the president in the chair.

Minutes of previous session read and approved.

Dr. H. J. Goslee then read his paper on "Principles and Technique of Root Preparation." Discussion was opened by Dr. H. W. Morgan, and continued by Drs. Carlton, Broomell, Guilford, and Essig, then closed by the essayist.

Dr. F. D. Weisse then read a paper on "Syllabus for Dental Curriculum." Discussion was opened by Dr. Guilford, and continued by Drs. Taft and Thomson, and closed by the essayist.

The committee appointed to consider the president's address then made the following report:

To the President and Members of the National School of Dental Technics:

GENTLEMEN,—Your committee appointed to consider the president's address desires to make the following recommendations concerning the matter contained therein:

1. We recommend that the name of this organization be changed to the Institute of Dental Pedagogics.

2. We further recommend the appointment of a committee to consider the unification of the curriculum, said committee to collect such data as they may deem necessary for the purpose of making a report and a recommendation at our next annual meeting.

3. In regard to holding the annual meetings at points where colleges of exceptional facilities and equipment exist, we believe that while such points have some advantages, as suggested by the president, our meeting places should not be selected with that sole object in view. Some of the smaller schools might well be stimulated to an increase in apparatus and facilities by the prospect of a visit from this body. Geographical conditions will also enter into the matter. We approve of the recommendation regarding visiting the schools in the city in which we meet.

Respectfully submitted,

(Signed) GEORGE E. HUNT,
THOMAS E. WEEKS,
A. E. WEBSTER.

Motion to accept the report was then carried.

Motion made by Dr. Stellwagen to substitute the word "stomatological" for "dental," so that the name of the organization would be Institute of Stomatological Pedagogics, was not supported.

ved, then, that the report be adopted. Supported and car-

W. H. Whitslar then read his paper on "Operatory Meth- Discussion was opened by Dr. W. E. Willmott; continued s. Cattell and Foster, and closed by the essayist.

next regular order of business was the election of officers, resulted as follows:

sident, Dr. H. P. Carlton, of San Francisco, Cal.; vice-presi- Dr. George E. Hunt, of Indianapolis, Ind.; secretary-treas- Dr. H. J. Goslee, of Chicago, Ill.; member of Executive , Dr. W. Earl Willmott, of Toronto, Canada, for three years, ceed Dr. George H. Wilson, term expired.

Executive Board now stands: Dr. Henry W. Morgan, chair- one year; Dr. D. M. Cattell, two years; Dr. W. Earl Willmott, years.

ourned.

FRIDAY, DECEMBER 29, 11 A.M.

eting called to order, with President Hoff in the chair.

nutes of the previous session read and approved.

nmittee appointed to consider the advisability of making, name of the association, an exhibit at the Paris Exposition, presented the following report:

President and Members of the National School of Dental Technics:

TLEMEN,—Your committee appointed to report on the advisability of an exhibit at the Paris Exposition beg leave to submit the following: opinion an exhibit should be made, and we herewith recommend the ng method: The exhibit shall not include methods of teaching, but nclude the finished product of the student. An adequate exhibit shall cted by a committee appointed for that purpose from among the arti- fered by the various schools. No credit in any way, shape or form e given to any individual school contributing to such an exhibit, as it be strictly an exhibit of the work done by the dental students of ca.

further recommend that an album or book be exhibited containing the raphs of such schools, members of this association, as desire to be nted, together with building plans and other items of interest.

urther recommend that a chart or syllabus be made giving the various es taught by and in the schools of this body, and the average amount spent in or devoted to each branch. This chart should be as com- sive as is consistent with such an article, but should not go into details regarding the various branches or methods employed. It also include the entrance requirements.

In carrying out the above, we recommend the appointment of a committee with power to act.

Respectfully submitted,

(Signed) TRUMAN W. BROPHY,
GEORGE H. WILSON,
HENRY W. MORGAN,
GEORGE E. HUNT.

Motion to the effect that the report be accepted and adopted then made and carried.

Moved by Dr. Guilford that the sum of fifty dollars be appropriated for use of meeting room in hotel.

Moved to amend by appropriating thirty dollars. Amendment supported and carried. The motion as amended then prevailed.

Report of Executive Board concerning the application for membership of the Washington Dental College, to the effect that they were ineligible until becoming a member of the National Association of Dental Faculties, then presented and approved.

Dr. Otto Arnold then read a paper on "The Use of Text-Books in Class Work." The chair announced that as this paper was intended as a preface to the symposium to follow, the discussion would be postponed until the reading of such papers, and then be general. This announcement was received and approved.

The following papers on text-books were then read:

"Prosthetic Dentistry," Dr. I. N. Broomell.

"Dental Pathology," Dr. A. H. Thompson.

"Oral Surgery," Dr. Truman W. Brophy.

"Dental Therapeutics," Dr. James Truman.

In the absence of the latter, his paper was read by the secretary.

The discussion was then opened by Dr. George E. Hunt, and continued in lively manner by Drs. Barrett, Smith, Webster, Wilson, Grant, Morgan, Taft, and Weisse; then closed by the essayists, Drs. Arnold, Thompson, and Brophy, finishing what proved to be one of the most interesting sessions of the entire meeting.

A committee was then appointed to escort the newly elected officers to their chairs, and they were then duly installed, each replying with words of appreciation.

The new president, Dr. Carlton, then appointed Drs. Brophy, Whitslar, and Goslee as a committee of three to arrange for the making of an exhibit at the Paris Exposition, as provided for in the resolution adopted.

Ioved and supported that a vote of thanks be extended to the al Committee of Arrangements, to the college faculties for the rtesies extended, and to the hotel management, each motion ailing unanimously.

motion was then made to continue the Committees on Opera- and Prosthetic Technics, which was supported and carried nimously.

here being no further business, the meeting adjourned.

TE.—List of membership colleges with duly accredited representatives nt, dues paid and entitled to vote:

llege of Dentistry, University of Minnesota.
ntal Department, Vanderbilt University.
uisville College of Dentistry.
yal College of Dental Surgeons.
ntal Department of Western Reserve University.
icago College of Dental Surgery.
ntal Department, University of Michigan.
io College of Dental Surgery.
ntal Department, University of California.
liana Dental College.
ntal Department, University of Buffalo.
ntal Department, University of Pennsylvania.
ltimore College of Dental Surgery.
iladelphia Dental College.
nnsylvania College of Dental Surgery.
ntal Department, Ohio Medical University.
tsburg Dental College.
w York College of Dentistry.

By Proxy.

rthwestern University Dental School.
ntal Department, University of Omaha.

Membership Colleges without Accredited Delegates.

ntal Department, University of Iowa.
mingham Dental College.
stern Dental College.
ntal Department, Columbian University.
nsas City Dental College.
ntal Department, University of Tennessee.
partment of Dentistry, Southern Medical College.
anta Dental College.
cinnati College of Dental Surgery.
ntal Department, Detroit College of Medicine.

Dental Department, Marion Sims College of Medicine.
Dental Department, Milwaukee Medical College.
Missouri Dental College.

Total membership	33
Colleges represented by delegates	20
Colleges without delegates	13
Applications received	1

Respectfully submitted,
(Signed) H. J. GOSLEE, *Secretary-Treasurer.*

PRESIDENT'S ADDRESS.

BY N. S. HOFF, D.D.S.

ntlemen of the National School of Dental Technics: Follow-
ne precedent of my predecessor in office, and at the invitation
ur Program Committee, I beg your indulgence while I try in a
way to direct your attention to some particular functions of
organization, which, it seems to me, should be carefully con-
ed at this meeting or in the very near future, in order that we
successfully meet the demands made upon us and the expecta-
and hopes of our enthusiastic supporters.

seems to me that the one demanding our first consideration is
to which my predecessor so ably directed your attention one
ago, and upon which you did not at that time feel prepared to
I refer to the advisability of changing the name of the organ-
on so that it would include the larger conceptions we now have
ur work. I do this not because I am not satisfied with the
entation made by my predecessor, but because I believe we are
more in accord with the idea and better prepared to consider it.
n the present name for this organization was adopted it was
ested by gentlemen who were full of enthusiasm, because they
found a systematic and satisfactory method of presenting the
ect of operative dentistry from the purely technical standpoint
heir classes. And, believing others would be interested in the
e system and would be helpful in its future development, they
eived the idea of organizing a class or school of instruction.
rosthetic technics was added later, and the name, National
ool of Dental Technics, seemed to be not only appropriate, but
ely adequate. But as time passed, and the value of the several
ings held began to appear in the great advance made, and
use of the stimulus started by the discussions had and the

exhibition of actual results obtained in work accomplished by the students, teachers in other subjects of the dental curriculum became interested, and asked that their work might also be recognized and admitted for consideration; until at this time there is a persistent demand that the scope of our organization be enlarged, and possibly its name changed so as to admit at least all the specially correlate subjects of a practical or technical character, if not the entire dental curriculum. This subject was considered of so much importance last year that your president's address at the last meeting called especial attention to it, and suggested it as a very proper subject for consideration.

The idea has met with some opposition, largely from those who fear that the past usefulness of the organization in developing and maintaining interest in the purely technical subjects may be impaired or obscured by long discussions of a purely pedagogical nature on subjects which, while important as fundamentals, are generally taught by science teachers having no particular knowledge of dental technics.

This objection, it seems to us, has no considerable justification, because of the fact that none of these subjects have ever been considered or offered for discussion in our meetings; neither have the teachers in these departments manifested any considerable interest in our meetings. It is very possible that we should be largely advantaged by having such teachers—many of whom are specially educated for their occupations, and devote their entire lives to teaching—discuss their particular problems in our meetings. And we might well afford to give them the time necessary to gain that which shall enable us not only to impart technical knowledge, but to instill correct intellectual habits with our instruction. In the excellent address of Professor C. M. Wright at our meeting one year ago he made this statement, which is well worth considering in this connection, "Every one who has been placed in the position of a teacher has thought much about methods, but definite notions are rare." Is it not true that the large majority of our technic teachers have taken up the work without any special preparation, and hold their positions as a result of mere accident?

Does it necessarily follow that because a man has made a success in the practice of his profession, he is therefore qualified to administer the affairs of an institution organized to educate pro-

ional men? Or because a man can make a beautiful and artistic ıg that he is the man to instruct others in the same art? Is it too true that many of our teaching faculties are organized on e standards?

.nd men are put into positions as teachers or leaders of thought action who, while abundantly able to execute and probably to k satisfactorily for their own necessities, yet come far short neasuring up to their opportunities from a pedagogical stand-ıt. As Dr. Wright suggests, such teachers must think much as nethods and try many costly experiments, and only arrive at ıite notions after long experience. Would it not therefore be he greatest value to us, mostly teachers by accident, to have the efit of the counsel and experience of those who, because of r education and experience, ought to be qualified to be helpful roadening our outlook and giving us a larger conception of our ?

am not pleading for less of the purely technical, nor for the agogical exclusively, but, for reasons implied if not ex-ssed, I fear we shall not be able to sustain the present interest accomplish our purpose unless we are willing to take a broader of the subject. I feel confident that we should take a con-ative action in declaring at once our purpose and desire to uss fully not only the purely technical subjects of our curric-n, but also such as have an indirect relation to what are called "practical chairs." Fortunately we are to test this idea, to some ent at least, in the present session. Your Executive Committee given us this year a program which I am sure will develop this ight more vividly than I can hope to do in calling your attention here briefly.

we are to admit other subjects than the technic of operative prosthetic dentistry, we should, to some extent at least, define object of the association, so that in the future the limits of our may not be questioned. Some still believe that the place for agogical discussions should be in the meetings of the National ociation of Dental Faculties, and claim that this organization t always be looked upon as a section of that body and subject ts decisions in all questions involving changes in methods of arting instruction; others express the hope that the time will come when the National Association of Dental Faculties will

take up the work now done by this organization with more effectiveness, because it will be able to command obedience to any conclusions reached, while this organization has no power to enforce its edicts.

We are of the opinion, and many others we know hold the same, that from all present indications there is no hope that the National Association of Dental Faculties will very soon, if ever, be in a position to calmly and thoroughly take up the subject of methods of teaching with the hope of any definite results. The time of the National Association of Dental Faculties is fully taken up with executive affairs of very little interest to teachers from the pedagogical standpoint, but of great value in a general educational way to our profession. And the sessions of that organization are so frequently the scenes of so great mental agitation as to render impracticable an unprejudiced discussion of anything so tame as a method of imparting instruction. Is there any one who was present at the recent meeting of the National Association of Dental Faculties who would be so rash as to venture the opinion that a pedagogical subject could have received adequate treatment in that meeting?

We are fully convinced by the interest manifested in the last two meetings of this organization that it has a mission, and is filling a place heretofore unoccupied in the work of dental education. And while many things of pedagogical interest must be given over to the National Association of Dental Faculties for final sanction, such as preliminary requirements, length of course, subjects taught, when taught, etc., the actual teaching work and the best ways of doing it must come through some distinctively organized body, such as the present National School of Dental Technics. This organization has not power to enforce its edicts; it should not in any case make laws, neither does it. It may influence legislation by educating its members or by creating a sentiment which shall result in wise legislation, but its time should never be taken up with legislation or with the discussion of purely legislative topics. We may increase the standard for entrance by demonstrating the necessity; we may lengthen the college course by showing the need.

We may likewise secure a scientifically graded or uniform course of study by discussing the time and place in our curriculum where a student will pursue certain studies to the best advantage. If we

ıre to accomplish so much it must be apparent to every one that we cannot narrow our scheme to the two practical branches only, and in heir technical aspects. We must, in fact we are bound to, take in he whole curriculum, and every subject contained in it should be ı proper one to bring before this body.

If we are then to broaden our scope of work, it seems that it will be highly proper and necessary to change the name of our organization so that it will express the objects we have in view. At the previous meeting the name "School of Technology" was suggested n place of "School of Technics," which is certainly more in harmony with our present ideas. We would further suggest, as we are not a national organization,—having at least one member from another country,—that we substitute "American" in place of 'national." And since we do not meet in the capacity of a school, which term pertains largely to the primary departments of education, while we all profess to be masters, and especially since we do not, in any usual acceptation of the term, conduct a school with a master and pupils, but our proceedings are more in the nature of a convention, that the term "institute" would more accurately define our organization; and since we meet to discuss or consider the science that treats of the facts and principles of our art, the term "technology" is amply expressive.

Therefore we suggest that the name of our organization be changed to that of the "American Institute (or Convention) of Dental Technologists." Such a name would be comprehensive and dignified. It sufficiently localizes the organization, and defines its purpose in terms that can be appreciated the world over. It permits of unlimited expansion, and yet is distinctively inclusive. An experience of three years in providing programs for discussions by this organization justifies me in urging that you take up this matter at this meeting and settle definitely the policy and sphere of action for this organization, so far as may be done constitutionally.

My predecessor in office last year suggested this change as a possibility, and I most earnestly recommend it as a necessity at this time, if we are to obtain the greatest usefulness from the organization and continue the wonderful interest of the last two meetings and the promising success of the present one.

Another matter which it seems to me demands early consideration is the curriculum of study in our dental schools. I am fully aware

of the fact that I am broaching a subject for endless discussion possibly, and one which may belong to another organization. My conviction, however, is that no organization is so well calculated to adjust this problem satisfactorily as this one, for the reason that it will never be satisfactorily adjusted except on purely pedagogical principles and practices. It should be discussed entirely from that viewpoint. If our profession has any justification in its classification as an art or science, it must be built upon principles. If so, what are they, and how shall we best illustrate them to such as may be seeking knowledge of them? Is it necessary that a dentist should know more than the anatomy of the teeth or their immediate environment, or more physiology than will enable him to artificially supply dental organs lost accidentally or by disease, or more chemistry than will enable him to bleach a stained tooth? Is it possible that we are spending entirely too much time studying anatomy, physiology, chemistry, bacteriology, general pathology and surgery, at the expense of the more important technical details? Do we devote so much of our time to the study of purely medical sciences as to seriously interfere with the development of such technical skill as is demanded by our art in the practice of our profession?

I shall not attempt to discuss these questions here, or at least now, but I bring them before you because I believe they are not only pertinent subjects at this time, but that they are fundamental, and should be considered before we proceed to consider the best methods of presenting them to our classes. Let us determine if we can whether we need them at all, and, if so, to what extent. Then we shall be ready to give them their proportionate time and place in the curriculum, and be prepared to forever silence the teacher who assumes to say that the dental student does not need this or that; also the indolent student who is forever wanting to know of what use this or that particular study will be to him when he gets into the practice of his profession.

There is here a large field for discussion and plenty of room for difference of opinion, and it may seem like a problem of too many unknown quantities to give us any hope for satisfactory solution. It seems to me, however, that it is a matter of the greatest importance, and we cannot escape its consideration if we dare hope to put our educational system on a uniform and scientific basis.

It is a large and formidable problem, but none too large or formidable for the wisdom, courage, and fraternal spirit which has and does characterize the membership of this body. And I commend it for such early consideration at the hands of our Program Committee as may seem expedient.

Another matter which it seems to me would add interest to the proceedings of this body is that our meetings should be held in such places as are located schools having unusual opportunities in the way of teachers of recognized abilities, buildings well planned and equipped for imparting instruction, or other advantages which might be utilized by the less favored schools. And that a systematic visitation and inspection of not only the buildings and equipment be made a special order of the program, but that such schools be put on the program, and that their methods of management and of imparting instruction be as fully demonstrated as is practicable.

This has not been done before by this body because it was thought that the meeting should be held entirely distinct from any college, to avoid any unpleasant jealousies which are apt to manifest themselves where there are two or more schools located in the same city. It may be that such a course was advisable when this organization was younger and contained representatives from only a few of the schools, but since it has become strong enough to take care of itself, and contains most of the schools in its membership, it does seem as though it had earned the right to be independent and take some risk for the sake of benefiting its constituents as much as possible.

As an illustration, it was thought by some of the members of the Executive Board that it would be very desirable to set apart some of the time allotted to this meeting for visiting the schools in this city; this being one of the oldest and best-known educational centers in the United States, and containing three of the oldest and most creditable schools, each having an excellent building and equipment, and the members of their faculties are well known and thought of the world over.

Could we not well afford the time necessary to make a reasonable inspection of the facilities at least which these institutions possess, and also an idea how they are utilized? There are many things in connection with the school in which I teach that I am always glad to show any one interested in teaching this line of work, and I know that every other teacher has the same feeling and experience.

I am very sure there are some particulars in which each of the schools of this city are doing better and more thorough work than is being done by the rest of us, and it would be well if we could see their facilities and learn of their methods. At least it would give us a chance to compare notes, and would be the means of generating a spirit of emulation which could not be otherwise than helpful in results.

In conclusion, allow me to commend to you for your thoughtful consideration these items to which I have directed your attention, believing that in each lie possibilities for still further advancing the usefulness of this organization, and through it the elevation to a higher plane of our system of dental education.

DISCUSSION.

Dr. KIRK, opening the discussion. Mr. Chairman and members of the association: The address to which we have just listened is so thoroughly in accord with my own views upon the subject that it is quite difficult to discuss it. Certainly there has been little said that is open for criticism. The suggestion that the association change its name to harmonize more definitely with its avowed purpose is one which should meet with cordial and sympathetic approval and reception.

As I take it, we are not here for the purpose of studying new methods of performing technical operations in operative and prosthetic dentistry alone, but we are here avowedly for the purpose of studying better methods of teaching technical operations to students. The fundamental idea of the association is a pedagogical one. We are here that we may better educate ourselves as teachers and as demonstrators. At the beginning we confined ourselves to one or two branches of the curriculum. It seems to me we should extend beyond that idea, that we should study teaching methods in all the branches of the curriculum. There is a necessity for this expansion. What dentistry needs to-day more than anything else is properly trained and educated teachers. It is quite true, and I think there can be no difference of opinion as to the point raised by the president,—viz, that the simple ability to do technical operations or to perform any of the requirements of our calling does not in itself constitute a man a teacher. A teacher is something else. He must have the ability to convey the idea and understanding, the skill

power to perform these operations, to another individual. I am
earty accord with the idea that we should extend the study of
hing methods to all subjects in the dental curriculum.
/ith regard to the proposed change of name, I am not able to
that the suggestion which our president makes as to calling us
nologists differs essentially or etymologically from our present
gnation. If we are merely studying technics we are technolo-
s. I would include what I deem to be the fundamental idea of
association—namely, the pedagogical idea—in its designation.
t we are here as pedagogues of dentistry, which includes teach-
as an art as well as a science in the elements of our profession.
t is a matter which it seems to me is so important that it should
eferred to a committee to take into consideration and report at
meeting.
would raise a question as to the word "practical" in designating
faculty chairs. That has been one of the stumbling-blocks in
way of preparing a satisfactory curriculum, and if in using the
d practical it is indicated that we are teaching some subjects that
not practical, I must take exception to it. I do not know that the
ident meant to imply that, but if there is anything that is more
tical than a knowledge of anatomy, physiology, bacteriology,
nistry, and so on, I should like to know about it. It seems to me
are the most practical things we have to deal with. Certainly
ractitioner who meets properly the demands of his patients will
that a proper knowledge of these fundamental branches is
ntial, and therefore most valuable. Besides having the ability
into a laboratory and make a tooth, there is the other scientific
of knowing the principles involved in doing it. We should not
te confusion by calling one side of it practical and the other, by
ication, impractical and theoretical. Even theory is a practical
g; one of the most practical things we can deal with. For a
mon example, when certain atmospheric conditions are present,
n it is cloudy and the atmosphere is loaded with moisture, we
a theory that it will rain, and we practically make use of that
ry in taking an umbrella as a protection, and so I think the word
ory" should not be used in such a confusing sense.
/ith regard to the National Association of Dental Faculties, it
s to me practically impossible, as the president has said, for the
ional Association of Dental Faculties to fully deal with these

pedagogical questions. Its time is taken up with questions of administration and legislative questions, which exclude the broad consideration of these subjects; but, as a matter of fact, the membership of this association is largely the same as that of the National Association of Dental Faculties, so that what we do here could be legitimized by them if thought desirable. If we express an opinion and come to an agreement affecting the matter of a curriculum it could be legitimized by the National Association of Dental Faculties, for, consisting largely of the same membership, the two bodies would work harmoniously. It is important that this society should concern itself largely with the study of teaching methods, and leave the legitimizing or legalizing of the result to the body which is constituted for that purpose.

With regard to the subject of uniformity of curriculum, I would call attention to the fact that we may overdo the unification idea. It would be perfectly possible to unify the curriculum so that the work in each school should be the exact counterpart of the other, but it is illogical to attempt to create a body of dental practitioners as the product of such an educational system in the same way that the government creates soldiers, a lot of men cast in the same mold, all of the same type, and who work as automatons. There must be the element of individuality in all of the dental schools. There is a process of natural selection going on by which I think these minor differences in the curricula will largely adjust themselves. I do not wish to be understood as taking exception to the idea of a reasonable degree of unification, but let us not go so far as to crush out the individuality of the separate schools or the practitioners who are their product.

The next idea to which my attention was drawn was the question of the overbalancing of the dental curriculum on the one side as against the other. There may be a possible tendency to give too much time and study to the theoretical side of anatomy, pathology, and so on, to the disadvantage of the technic of the work. I think we are at present facing a very serious danger in that regard. I believe the solution of that difficulty should be found not in reducing in any degree the amount of time or attention that is given to this so-called theoretical or scientific side, but by an increase in the length of time devoted to the whole curriculum. I think any man who looks at this subject from an unprejudiced point of view

admit that there is no study either in the technical or theoretical that we can dispense with. It seems to me that if dentistry is ccupy the position it should rightly assume and achieve the ities we claim for it, we must take a position on a level with the r specialties of the healing art. I don't think we can afford to il any one of the branches. We must look this fact fairly and rely in the face; that it does take and will take at least four s to properly equip a man for the intelligent practice of den- y. It is true, as it is true of other medical and scientific special- that four years is none too ample for the work.

ith regard to the final suggestion, that of the association visit- schools, the idea is an intensely practical one, and one which s directly upon our work here. It is an education in itself. I e into this room and saw one exhibit, the first exhibit that was lled here, and I felt I was fully repaid for any effort I might taken to come here. In following the suggestion of the presi- that we visit these institutions, we ought to be able to pick up s that would be of very great use to us.

r. H. A. Smith. I can only recommend the paper as being able, and as covering the whole ground fully. I feel as gh I can say very little after the able discussion of our friend Kirk. If you will observe the trend of the address, you will ce that it is following in line with the suggestions made by the ident last year. Dr. Hoff, our president, in the exuberance of youth has gone a little further, and reiterates certain changes h Professor Black suggested. I made a few remarks in refer- to the suggestions of Dr. Black last year, and I know no reason hanging what I thought proper for the society to adopt at that . I claimed then that to extend the scope of this organization ld be a usurpation of the purposes of the Faculties Association, I still think so.

sat by Dr. Hoff at that meeting on one or two occasions, and ticed that his eyebrows were drawn down, and that he was ty thoroughly disgusted with some of the things done. After meeting adjourned we thought or reasoned this way about it: e can change the methods of the Faculties Association so that time will not all be consumed in useless wrangling, that there the proper place to discuss methods of teaching and curricu- , and all that, but after a little lapse of time I have come to

the conclusion that perhaps we had better keep within the definite lines of the purposes of this organization for a while, and give that body a chance to rise to its proper height. It is possible for that body to consume all of its time in questions of administration. There are certain burning questions before the dental profession to-day, and how long it will take to settle them I don't know; but so long as these questions are so prominently before the profession, it must necessarily consume very largely the attention of the Faculties Association. I think in time it will get away from all that, and when it does it will be the proper body to discuss the curriculum and methods of teaching. It is a representative organization, and can enforce its laws. This is more of a convention organized for a specific purpose: to cultivate and develop the so-called practical subjects in dentistry and dental technic. It seems we have not found enough in these subjects to occupy our attention. Although we have been in existence only three years, there is a cooling in the interest manifested in the exhibits, for instance. I come here, as Dr. Kirk has said, and see one exhibit, and may be compensated, but there is not enough in this alone to interest a body like this year in and year out for a quarter of a century, and we are reaching out for something that will interest us, and in doing that we are infringing the prerogatives of another organization; and, rather than take action, I would advise a further discussion and consideration of the whole question. Dr. Black was doubtful last year whether it was practical at that time; Dr. Hoff says now is the accepted time. I think it would be well to let the Executive Committee take the liberty of bringing in such questions as it chooses for the next two years, and keep on in our old way. This body is young; it must make a record in some way, and that is along the lines for which it was organized.

So far as the question of curriculum is concerned, I don't see that it concerns this body very much, but I need not go into that. If we do it is merely in the way of suggestion, for we have no power to enforce our ideas; the Faculties Association is the proper body to do that. I don't know that I have anything further to offer in that direction, as Dr. Kirk has quite thoroughly covered all the points.

Dr. W. C. Barrett, of Buffalo. I am in sympathy with the main part of the remarks of Dr. Smith. You can't make a part

tter and bigger than the whole. We must have some unity; me central thought; some central power; some single standard ound which we can rally for the purpose of making a profession. vo rival heads in teaching, two rival associations, provided there rivalry, will always work at a disadvantage. I have always been favor of, and at one time introduced a resolution in the National ssociation, which was referred to a committee which never conlered it, that the National Association should hold semi-annual eetings, and have possibly a division of that into sections, and ake all teachers eligible to membership, and let them consider chnical as well as methods of oral and didactic instruction, and at the annual meetings be solely devoted to business. That ould make a complete organization. We must not lose sight of e fact that an organization or association which is to be a rival another must result in confusion, and seriously interfere. The ture is what we must look to, and not simply the present.

As for the matter of unification, I don't think that is practical at l, and trying to secure a uniform curriculum for all the colleges ems to me to be futile. I can readily see the advantage that ight result in it from the exchange of students from one school to other. If they all have the same instruction, a student can go om one to the other without repeating the instruction and without sing something that might be essential to him. But I do not ink this should be encouraged. Our school has a complete aded course, no two classes ever coming together, everything ing graduated from beginning to end. Others have no graded urse, but go from one subject to another until they are through, thout particular system. But to force all into the same rut uld be an arbitrary application of force which I should not favor. elieve we are doing pretty well as it is. I believe the most adable thing is a semi-annual meeting of the National Association Dental Faculties; and in due process of time institute sections in t body so as to permit the discussion of all educational matters, whatever kind; then the annual session can be devoted to busiss, which is as essential as methods of teaching students.

Dr. G. E. HUNT. If my memory serves me right, this matter en it was brought up last year was discussed by Drs. Smith and rrett in much the same language as this morning, and Dr. Kirk l myself said about what he has already said and what I expect

to say, and probably the reading of last year's minutes would save all this. I am, however, surprised to hear Dr. Barrett say that there are schools in the Faculties Association that have not a strictly graded course. I was totally unaware of that.

Dr. Barrett. You are not posted.

Dr. Hunt. That may be, but I am surprised to hear it. As far as this body attempting to pass any laws in regard to the unification of the curriculum or on any other subject which affects colleges we all know, I think, that that is an utter impossibility. We cannot do it. We have power to make suggestions, which would probably be received with more or less favor by the men who do shape the laws which govern these colleges. In fact, there are a good many of us here to-day that are representatives of these same colleges at the Faculties Association, and it is natural to suppose that anything we agree upon here we would be able to agree upon there. I know we cannot pass laws which will control the Faculties Association, but we can pass resolutions and give opinions which will be received with a great deal of weight by that organization. The Faculties Association should do these things, but it is not doing them, and I don't think ever will; and, since that is the case, why can't we save time and trouble by coming to conclusions ourselves? I think this is pre-eminently the body which should consider these matters, and if we don't consider them now they will never be considered in the future.

In regard to unification of the courses, I agree with Dr. Barrett that a complete unification of the course cannot be accomplished at this time. But I think a partial unification can be accomplished, and that it would be a most excellent thing for all of the colleges. I don't think the methods of teaching any particular subject can be followed by every other school and get the best results, but I do believe that the amount of time spent on most, if not all, subjects can be settled by this body. For instance, some schools teach chemistry three years; some only two years. Some teach anatomy only one year; some two, and, for all I know, three years. These things can be adjusted. If two years is sufficient to teach anatomy in the University of Pennsylvania, it is enough to teach anatomy in the Indiana Dental College. If two years are necessary for chemistry in one school, it is necessary in another. Of course, we cannot define methods of teaching for each school, but

can define the length of time to be spent on them. If we uld unify the courses so as to define the minimum amount of time be spent on the various studies, we would accomplish much. e have students coming from other schools, and it is very seldom at they do not go to the office and ask to be excused because they ve completed a certain subject in another school. I have no ubt others here have had the same experience. That could all done away with by unification to that extent only; that is, define e years in which certain branches shall be taught and nothing ore.

Dr. James Truman. I was not at the meeting last year, and ve not been present, with one exception, since the organization this body, for the reason that I was always in the hope, since I sisted in the organization of the Association of Faculties, that at body would take up the various subjects that this one has ken up particularly. But after fifteen years' experience in the ssociation of Faculties, hoping against hope, I have come to the nclusion that that body never will do anything more than legis- te on the various matters connected with our profession. It ems to me that that body of men have bottled up during the ar all their antagonisms and hard feelings and they come to that sociation to ventilate them, and the result has been, as it was at e Niagara meeting, continual fighting, if I may use the term, most from the beginning to the end. Now, to some of us this disgusting, and for one I am tired of it, and I believe that the lue of the Association of Faculties, whatever value it may have d in the past, is about completed. I am therefore here to-day to ke part in this association perhaps more prominently than I have eretofore, because I believe that this work is to advance and, as ated by our president, this body in the future will take an alto- ether different stand from what it has in the past. I am wholly accord with the views expressed.

So far as the views concerning the unification of the curriculum, don't think that is possible, but we can reach out toward that oint, and I think we should do so. When we come to consider lucation, not only in our branch but in other branches in general holastic training, there is a lack of unity throughout this whole ountry. It is altogether different from what it is on the Conti- ent, where there is unification in all the schools. Take, for in-

stance, Germany, where a young man can go from one school to another and start in one where he left off in the other. If we could reach that position here it certainly would be a great gain not only for general education, but in our own professional education. This body must do the work that the Association of Faculties has failed to accomplish. This was work we supposed that body would accomplish, but it has not done so. Who is in fault I do not know, perhaps I as much as the others. We have so much to do in talking and wrangling over legislative matters that we have entirely forgotten the primary object for which that association was formed. I think the original position of this association was crude, because it confined itself to prosthetic and operative principles. You have your exhibits here, and they do good work, but they are not the principal things. We want to know how to teach. As Dr. Kirk has said, we want to make teachers. We haven't got them in our profession. It is one of the most difficult things, I presume, that every dean has to contend with, to secure men who can teach in the different branches. Many men can do the work, but very few can teach; and such is the object, as I understand it, of this body, to so instruct men that they may become teachers.

Dr. T. E. WEEKS. I believe I am called upon to speak as one of the organizers of the National School of Technic.

It may be well to emphasize the thought that was in the minds of those who organized this association. There was but one thought, and that was based on the fact that the Faculties Association never had taken up subjects of an educational nature, and, as has been said, a number of the organizers were, or had been, representatives of their colleges in the Faculties Association, and had come to the same conclusion that the preceding speakers have expressed, that they never would. This school was organized primarily as an association of technic teachers, men who were trying to present in their respective colleges a systematic course upon such branches as could be taught to advantage by the laboratory method. But it very soon became evident from the interest manifested, not by technic teachers, but by teachers of every branch not represented by the laboratory method, that the scope of this organization must grow. And by its own force and impetus it will grow; we cannot help it.

I am particularly pleased, as one of the original organizers, to

come the new proselyte, Dr. Truman. Such men as Dr. Truman ıg with us, and others who looked upon us in somewhat the same ıt as he did, is an assurance of the continuous growth and success his organization. The one point I wish to emphasize is that our od friends who have spoken in the interest of the Faculties Asso- tion have nothing whatever to fear from this association. It was ver intended as, and it never will become, the rival of the Facul- s Association. From the nature of the constitution and pur- ses it never can be a rival to that association, and it never will ire to be. I cannot entirely sympathize with Dr. Truman's pression in regard to the Faculties Association. I certainly do wish to attend the obsequies of that association, but I hope it l swear off in a few things and lead a better life. In regard to own association, I don't believe that any member of the associa- n has ever voiced a sentiment or expressed a wish or desire to islate in any way. That is not the object. It is to present thods of teaching and to discuss them, that every teacher who ends will be benefited and will carry something away from the eting which will enable him to improve his course. While ab- ute unification never can result, still there may be a certain ount of unification which will be beneficial to all schools; that l be an inevitable result of our deliberations.

So far as the extension of the principles of this body, it is already ended, and we don't have to pass any resolution to extend it; it l extend itself. I think Dr. Barrett's suggestion is very good, will it ever come? That matter rests with the Faculties Associa- n, and not with us. It rests with the Faculties Association to end an invitation to this body to unite along these lines, and en it comes it will be time enough to consider whether we will ept it.

Dr. W. C. Barrett. There seems to be a misunderstanding as what the National Association of Dental Faculties' function lly is. The most important work ever done was done at the eting last summer. It was only done through a struggle. It ıld not be done in any other way. The schools and teachers, o alone know what the curriculum should be, can establish that riculum, free from the dictation of those who are not acquainted all with teaching. It is simply the establishment of a principle. e victory was complete; it is established, and it could not have

been done in any other way. I thank God for the fight we had last summer.

Dr. T. W. Brophy. The president's address, which was an admirable one, called attention to a criticism as to whether it would be expedient to continue teaching anatomy as it is now taught, according to the rules of the Association of Faculties, or in some other way; and the same with regard to physiology and chemistry. I am sorry that that was in the address, because it might lead some to think there were members in this body in doubt as to the advantages that students will acquire by the study of physiology, anatomy, chemistry, bacteriology, and other scientific subjects that are now taught in our dental colleges. It is essential that the young men should be taught these subjects. It is not possible for a man to comprehend a part of the body and understand its physiology and its pathology, and so on, without having a knowledge of the entire structure. If the dental profession ever comes to the conclusion that it is not necessary to teach these branches, it will be a retrograde step.

As to the usefulness of this body and its relation to the Association of Dental Faculties, I do not share with the unfortunate views of Dr. Truman in regard to the National Association of Faculties. The dental profession is on a very much higher plane to-day on account of the work of that great body, and if it had accomplished nothing else than the work done last summer through a long contention, it would have won a victory in the interests of the dental profession that would stand to the end of time.

This association is but a midget compared with what it will be. It is just in the beginning of its usefulness. It started for the sole purpose of teaching technics of operative dentistry; later it added prosthetic dentistry, and to-day it has a field of work before it that was apparently not dreamed of, and that is everything that pertains to the whole dental curriculum. The advance made in the field of physiology in the last ten years is something surprising to men who have not looked into it. Pathology, bacteriology, and so on, all these branches must come up, and by and by we will see them presented by the teachers who have charge of them, and the work of this body will expand in a better form than ever before, and you will find it one of the greatest educational bodies in this country. The National Association of Faculties cannot do this

It is not its function. It is a purely legislative body. It great work to do, and it must be done. Look at the number iools, and I am told there are about twelve new schools in this ry that want to come in. That will take time. Those who been in the Executive Committee know what it means to get ner three days before the meeting in order that the matter may t in shape for presentation to the association. It is true there sturbing elements now and then, but we hope it will be better d by.

lon't suppose Dr. Weeks and the other organizers ever ned this association would reach such proportions as we have It was through Drs. Weeks and Cattell that we branched s a School of Dental Technic. I don't like the name, Mr. dent, and I thank you for the suggestion to change it; change something which will indicate what its function is, and then grow as it will grow. We can't stop the progress of this as- ion any more than we can change the course of Niagara. We ave a curriculum and lay out a course of study, and change the ulum so as to include educational advancement, and after a we will have four years of work instead of three. I remem- hen the National Association was started, in some schools he term was but four months; and it has been changed to a ium course of three years of seven months; and soon we are to have four years of seven months, or possibly eight is. This has all been done by the work of the National Asso- n. And that body is going to go on and do the work before d if we have to fight, we will fight to accomplish our ends, e will win every time.

Hoff. I do not know what I can add to what has already so ably said, and better than I can state it. This convinces the fact that our session is too short. We ought to have had instead of an hour to discuss the subject, because I know are many here who are ready to speak on the subject more gth. I feel that I could take half an hour myself to amplify I only suggested.

iink we are all agreed so far as enlarging the scope of the ation, and the change of name is immaterial. The point in the address was that we should change our name so as to he Executive Committee power to incorporate in its program

for our consideration any subject it saw fit to place on the program. Now, we have simply usurped that function, and do it because we want to. We don't do it with authority.

As to the suggestion that this is to be a rival to the Faculties Association, none of us who have at heart the work of this association will for a moment consider that. We are not its rival. We are its helper; we are its right hand. That is what we organized for, and that is what we intend to be. It has been said that we must have the National Association; that it has an important function, but I am also strongly convinced of the fact that this body has a function. As was often stated last year, we are to decide what we are to teach, and then we can hope to devise a method of teaching it.

I purposely restated this that it might be in your minds, to be considered whether or not it might be well to take up that particular subject and discuss it thoroughly at this time, or arrange for its consideration in the near future. I don't think that any one here understands that I am in favor of a reduction of the amount of anatomy or chemistry, or any of the other subjects that we teach. I am in favor most heartily of enlarging the scope, but we are met every now and then with the question as to whether dentists ought to know all about anatomy and physiology, and so on. In our own school I have had the greatest difficulty in convincing the teacher of anatomy that the dentist needs to know much more than the anatomy of the mouth. And I have had difficulty in convincing our physiologist, who is a scientific man, and not a dentist, that our students need to know more of his subject than that which concerns the nutrition of the body. The most important thing we have in physiology, perhaps, is the nervous system. He claimed we didn't need it; insisted we didn't need it. And so it goes all the way through. What I think we should do, if possible, is to define our course; not that we shall be mandatory, but define it with the idea of establishing an *ideal* course of instruction for dental students; not that we shall make anything mandatory in one or any of our schools, but it shall be one which is, according to the consensus of opinion of this body, ideal, and then we shall have something to start from. If any school or teacher should desire to change that ideal or make another course, it would be perfectly right and proper for it to do so.

If the National Association of Dental Faculties passes a law

chools shall teach a certain amount of anatomy, there will ›re or less modification necessary for the various schools, se of their peculiar environment. I do not think it would sible or even desirable for the National Association to make uch legislation. It can, in general terms, indicate what be taught and when it shall be taught, but some liberty or ınce must be granted to every school. If I were the govern- ›dy of the Faculties Association I would abolish every law it acted, and I would enact in place of them a code of ethics, and hool that lived up to it would enjoy the privilege of living up nstead of obeying laws. I think we would not have as much gling as now. We want to raise the standard of general edu- and invite men to accept that as an ideal standard, and if they o modify it that is their privilege. We do not want to legis- all.

OPERATIVE TECHNICS.

By T. E. WEEKS, D.D.S., Chairman of Committee.

Dr. T. E. Weeks, Chairman. It was deemed best to present this in printed form, it being largely tabular and diagrammatic, and so would be very voluminous if presented in any other way.

(Copies of the report were placed in the hands of each member before the doctor proceeded to read.)

Last year your committee reported a brief syllabus comprising the technic of Dental Anatomy and operative procedure. At your request the committee will present an elaboration of the chart presented.

Chart.

1. Nomenclature.
2. Dental anatomy: (a) Study of external tooth forms; carving in natural sizes and form. (b) Macroscopic anatomy; cutting and describing longitudinal and transverse sections of natural teeth.
3. Instrument nomenclature; making models of instruments.
4. Cavity preparation and instrumentation: (a) Manipulation, grasps, rests, direction and control of force. (b) Sharpening instruments. (c) Forming cavities by measurement. (d) Preparing classified cavities with their instrumentation.
5. Cleansing and filling of root canals.
6. Filling materials; their preparation and manipulation.

These divisions comprise the subjects recognized as the ones which can be taught to advantage in the technic laboratory. No suggestion will be made as to the place in the curriculum which the work should occupy, nor is it expected that the syllabus will be adopted in its entirety by any school,—rather the effort is to give suggestions which will be helpful to all. These suggestions are the composite of several successful courses. The matter is presented as far as possible in diagrammatic or tabular form.

The first topic comprises the nomenclature of the teeth; of instruments and instrumentation, and of cavities. The first division will be given as the beginning or basis of Dental Anatomy technic; the other two come in their proper connection.

Nomenclature.

In describing the teeth the following nouns and adjectives are used:

NOUNS.

Surface,	Sulcus,	Thirds,
Plane,	Fossa,	Pit,
Margin,	Cusp,	Fissure,
Angle,	Tubercle,	Embrasure.
Ridge,	Root.	Horn.
Groove,	Canal,	

ADJECTIVES.

Incisal,	Distal,	Gingival,
Occlusal,	Labial,	Proximal or Proximate,
Axial,	Buccal,	Marginal.
Mesial,	Lingual,	

TE.—There are of course many other words which appear in the text-s, but these are the principal ones which form combinations under in definite rules.

SURFACE.
- Labial or Buccal, Mesial, Distal, Lingual — AXIAL SURFACES.
- Occlusal,
- Incisal (edge).

MARGINS.
- Labial or Buccal, Lingual Surfaces.
  - Mesial,
  - Distal,
  - Incisal or Occlusal,
  - Gingival.
- Mesial or Distal Surfaces.
  - Labial or Buccal,
  - Lingual.
  - Occlusal,
  - Gingival.
- Occlusal Surfaces.
  - Mesial,
  - Distal,
  - Buccal,
  - Lingual.

TE.—Marginal ridges take similar adjectives.

LE.—Margins and marginal ridges of any surface take the names of the ces which they approach.

ANGLES.
- LINE ANGLES.
  - INCISORS AND CUSPIDS.
    - Mesio-labial, Disto-labial, Mesio-lingual, Disto-lingual. — AXIAL LINE ANGLES.
  - BICUSPIDS AND MOLARS.
    - Mesio-buccal, Disto-buccal, Mesio-lingual, Disto-lingual, — AXIAL LINE ANGLES.
    - Mesio-occlusal,
    - Disto-occlusal,
    - Bucco-occlusal,
    - Linguo-occlusal.
- POINT ANGLES.
  - INCISORS AND CUSPIDS.
    - Mesio-incisal,
    - Disto-incisal,
  - BICUSPIDS AND MOLARS.
    - Mesio-bucco-occlusal,
    - Disto-bucco-occlusal,
    - Mesio-linguo-occlusal,
    - Disto-linguo-occlusal.

Line angles are formed by the junction of two surfaces along a line meeting at an angle.

Point angles (corners) are formed by the junction of the angles of three surfaces at a point.

RULE.—Both line and point angles take the names of the surfaces which form them.

- **RIDGES.**
  - INCISORS AND CUSPIDS.
    - LABIAL SURFACE.
      - Labial (cuspids).
    - LINGUAL SURFACE.
      - Lingual,
      - Marginal,
      - Linguo-gingival.
  - BICUSPIDS.
    - BUCCAL SURFACE.
      - Buccal.
    - OCCLUSAL SURFACE.
      - Marginal,
      - Triangular,
      - Buccal,
      - Lingual.
  - MOLARS.
    - BUCCAL SURFACE.
      - Buccal ridge.
    - OCCLUSAL SURFACE.
      - Marginal,
      - Oblique,
      - Triangular,
      - Mesio-buccal (triangular),
      - Disto-buccal "
      - Mesio-lingual "
      - Disto-lingual "
- **GROOVES.**
  - INCISORS AND CUSPIDS.
    - Labial,
    - Lingual,
    - Linguo-gingival.
  - BICUSPIDS.
    - BUCCAL SURFACES.
      - Buccal
        - Mesial,
        - Distal.
    - OCCLUSAL SURFACES.
      - Central,
      - Triangular
        - Mesial,
        - Distal.
      - Mesial,
      - Distal.
  - MOLARS.
    - BUCCAL SURFACES.
      - Buccal,
      - Disto-buccal,
    - LINGUAL SURFACES.
      - Lingual.
    - OCCLUSAL SURFACES.
      - Mesial,
      - Distal,
      - Lingual,
      - Buccal.
      - Disto-lingual,
      - Mesio-lingual (upper molar).
      - Mesio-buccal.
      - Disto-buccal (lower molar).
- **LOBES.**
  - INCISORS, CUSPIDS AND BICUSPIDS.
    - Mesial,
    - Middle,
    - Distal,
    - Lingual,
  - MOLARS.
    - Mesio-buccal,
    - Disto-buccal,
    - Mesio-lingual,
    - Disto-lingual,
    - Distal (lower first molar),
    - Fifth (upper first molar).

NOTE.—In bicuspids and molars the cusps bear the same names as the obes.

- **ROOTS OR CANALS.**
  - UPPER BICUSPIDS.
    - Buccal,
    - Lingual.
  - UPPER MOLARS.
    - Mesio-buccal,
    - Disto-buccal,
    - Lingual.
  - LOWER MOLARS.
    - Mesial
      - Buccal,
      - Lingual,
      - (canals),
    - Distal.

- **HORNS. (of the pulp)**
  - INCISORS.
    - Mesial,
    - Distal.
  - BICUSPIDS.
    - Buccal,
    - Lingual.
  - MOLARS.
    - Mesio-buccal,
    - Disto-buccal,
    - Mesio-lingual,
    - Disto-lingual.

DIVISION INTO THIRDS.

All surfaces of teeth may, for better description, be divided into thirds—oth longitudinally and transversely—in two directions.

- **THIRDS.**
  - TRANSVERSE. (Axial Surfaces)
    - Incisal or Occlusal,
    - Middle,
    - Gingival.
  - AXIAL. (Axial Surfaces)
    - Labio-lingually.
      - Labial or buccal,
      - Middle,
      - Lingual,
    - Mesio-distally.
      - Mesial,
      - Middle,
      - Distal.
  - OCCLUSAL SURFACES.
    - MESIO-DISTALLY.
      - Mesial,
      - Middle,
      - Distal.
    - BUCCO-LINGUALLY.
      - Buccal,
      - Middle,
      - Lingual.
  - ROOTS.
    - Gingival,
    - Middle,
    - Apical.

- **PITS.**
  - INCISORS AND CUSPIDS.
    - Lingual surface.
      - Lingual.
  - BICUSPIDS.
    - Occlusal surfaces.
      - Mesial,
      - Distal.
  - MOLARS.
    - Buccal surfaces.
      - Buccal.
    - Lingual surfaces.
      - Lingual.
    - Occlusal surfaces.
      - Central,
      - Distal.

FISSURES.	INCISORS.	Lingual surface.	Linguo-gingival (upper lateral).
	BICUSPIDS AND MOLARS.	Nearly all the grooves may show fissures, which bear the names of the grooves in which they appear.	

EMBRASURE—of the interproximal space: "That portion of the interproximate space that widens toward the buccal or labial or toward the lingual."—Black.

DENTAL ANATOMY.

In teaching external tooth forms there are certain points to be emphasized.

1. Arrangement in the arch.
2. Notation and formulæ.
3. General form.
4. Crown, root and gingival line.
5. The surface of the crown.
6. Division into thirds.
7. Angles of the crown and of the surfaces.
8. Margins of surfaces.
9. Ridges on surfaces and marginal ridges.
10. Fossæ, where found.
11. Sulci, names and location.
12. Grooves, of axial and occlusal surfaces.
13. Fissures and pits; location and cause.
14. Developmental lobes; number and position.
15. Interproximal spaces; size and form.
16. Measurement; compare Black's measurements with those of teeth coming under observation.

Illustration.

UPPER CENTRAL INCISORS (*Notation*[1]).

1. General form: Each incisor tooth has four surfaces and an incisal or cutting edge. It is divided into crown and root, the gingival line marking the division. An incisor tooth may be represented by a wedge and a pyramid united at their bases, the wedge standing for the crown and the pyramid for the root (see diagram.—P. 67, report for 1898).

2. Angles: There are four axial line angles; viz,—mesio-labial, mesio-lingual, disto-labial, and disto-lingual; and two point angles, mesio-incisal and disto-incisal.

3. Labial surface (la,); describe margins, angles, and planes.

4. Lingual surface (li,). The same. Note difference from labial.

5. Mesial surface (m,). Note form and contour.

6. Distal surface (d,). Note difference from mesial.

7. Gingival line. Note curvature for each surface.

8. Ridges. Locate and name those found on any surface.

9. Fossæ, grooves, pits, or fissures. Locate such as are found on any surface.

'he root. Note carefully the general form and direction of curvature if ; also form, in cross section.

IOTE.—All the teeth may be analyzed in the same manner. Where such abi are used, page reference should be made to the text-book (Black's atomy).

Practical Exercises.

'here are four distinct methods in use for teaching tooth form.

1. The recitation method, using heroic models for demonstration, re-ring the student to point out on the model and name the angles, surfaces, les of surfaces, and surface markings, as ridges, grooves, pits, fissures, etc.

2. The drawing method, in which the student is required to draw the out- and to shade sufficiently to show surface markings—either normal size enlarged to scale—of all the teeth, or of one of each class.

3. The modeling method, in which the student is required to model in , soap, wax, or some similar substance all of the teeth or a representative each class, enlarged to scale.

4. The carving method, in which the student carves in ivory or bone one h of each class,—natural size.

'he first method needs no explanation or commendation, as its use and ie are evident.

'he second method need only to be used to discover its value. Authorities er as to whether drawings should be made natural size or enlarged, also ether they should be entirely freehand or laid out by measurement (to e if enlarged). We would suggest that the value of drawing is twofold; eaches form and it provides every student with a means of expression in . Where enlarged drawings are used and are made to measurement, nks (see p. 68, report for 1898) are very useful.

he third method was used before carving in ivory came into vogue; and ie still find it useful to teach correct form before attempting the carving. composite clay is the most practical substance to use, and the general ctions given for carving may be followed, using of course measurements, eased to scale.

he fourth method is doubtless the best of all practical exercises for teach- tooth form. There is a difference of opinion as to whether the carving uld be made to measure by Black's average measurements, which result composite tooth, or should be made by the eye after a selected tooth. ere the first method is employed the following syllabus has proved to be ful:

MACROSCOPIC ANATOMY.

Dissecting Longitudinal and Transverse Sections.

he points to be gained are:

The general form of the tooth in each aspect and the relative proportion rown and root.

The amount and form of the dentin in each aspect.

The form and thickness of the enamel.

4. The pulp chamber and canals, their location, size, and form as shown by the different dissections.

Practical Exercises.

Here again we have distinct methods.

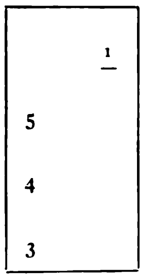
First method: Cutting longitudinal sections (one aspect) and transverse (gin. line and mid-root), mounting on card or blocks which bear printed annotation.

Second method: Cutting longitudinal sections, mounting on blocks; annotation made by student and silhouette printing on ruled sheet, as shown in Weeks's Manual, p. 11.

Third method: Mount on block and annotate ^{1}. File to expose pulp-chamber and canal; finish with fine sand-paper. (Every second man cuts a labial aspect, the others cut mesial aspects.)

Measure section cut in exercise 3, draw outline actual size, and record measurements on Form 2. (Each student makes measurements and drawings of each aspect of three teeth.)

Select and mount on block, ^{1}, having badly decayed crown; with a hack-saw separate the crown and root at gingival line; also divide the root into thirds, remount on block with large end up and annotate thus:



5. apical third.

4. middle third.

3. gingival line.

6. Make drawing actual size by measurement of sections cut in exercise 5 in proper place on Form 3. Each student make drawings of sections of three teeth.

All these methods have merit and are presented that teachers may select and combine to suit their special needs.

INSTRUMENT NOMENCLATURE AND CLASSIFICATION.

CLASSIFICATION OF INSTRUMENTS.	ORDER NAMES.	Those which denote the purpose.
	SUB-ORDER NAMES.	Those which describe position or manner of use.
	CLASS NAMES.	Those which describe the form of point.
	SUB-CLASS NAMES.	Those which describe the form of the shank.

XAMPLES OF SSIFICATION.

- **ORDER.**
  - Excavators,
  - Scalers,
  - Pluggers,
  - Accessories.
- **SUB-ORDER.**
  - Direct cutting excavator,
  - Lateral " "
  - Push scaler,
  - Pull "
  - Hand Plugger,
  - Mallet "
  - Gold "
  - Amalgam "
  - Root canal "
- **CLASS.**
  - Hatchet excavator,
  - Hoe "
  - Spoon "
  - Discoid "
  - Cleoid "
  - Sicloid Scaler,
  - Cleoid "
  - Smooth faced plugger,
  - Serrated " "
  - Convex " "
  - Flat " "
- **SUB-CLASS.**
  - Mon, bin, and triple angled excavator, plugger, etc.
  - Contra-angled excavator, plugger, etc.,
  - Spiral plugger,
  - Bayonet "

INSTRUMENT LISTS.

strument lists or sets are made up of *ordinaries, side instruments,* and *ials.*

inaries are the common forms of hatchet and hoe excavators.

ials are those designed for special acts in preparing cavities; as spoons, enamel hatchets, chisels, etc.

Instruments are those designated for some particular purpose.

TECHNIC.

he ideas of teachers vary so much as to the value of making instruments any outline for a technic course will be omitted. Your committee ld however indorse Dr. Black's opinion that students should be re-ed to form the various instruments in the set from some soft material brass. This work takes little time and impresses the formulæ upon student's mind.

he proper care and sharpening of instruments should be taught in the nic laboratory.

INSTRUMENTATION.

teaching the use of instruments there are certain points to be observed.

Grasps and rests.

The kind of work and place in the cavity for each form of instrument.

GRASPS.	PEN.	Holding the instrument as a pen is held in writing.
	INVERTED PEN.	Inverting the grasp so that the instrument is at right angles to the length of the arm.
	PALM AND THUMB.	Holding the instrument with the fingers against the palm of the hand so that the thumb is opposed to the working point.

RESTS.	FOR PEN AND INVERTED PEN GRASP.	By resting the third or fourth fingers, or both, upon a convenient point upon the teeth adjacent to the one which is being operated upon.
	FOR PALM AND THUMB GRASP.	By placing the thumb of the hand holding the instrument upon the tooth which is being operated upon, or an adjacent one.

NOTE.—The second point will be given in connection with cavity preparation.

CAVITY CLASSIFICATION, NOMENCLATURE, AND PREPARATION.

Classification.

CAVITIES.	PIT AND FISSURE. (No extension for prevention.)	Cavities in occlusal surfaces of bicuspids and molars and lingual surfaces of upper incisors.
		Cavities in the occlusal two-thirds of the buccal and lingual surfaces of molars.
	SMOOTH SURFACE. (Extension for prevention.)	Cavities in the gingival third of the labial, buccal, and lingual surfaces.
		Cavities in proximal surfaces of incisors and cuspids which do not involve the mesial or distal incisal angle.
		Cavities in proximal surfaces of incisors and cuspids which do involve the mesial or distal incisal angle.
		Cavities in the proximal surfaces of bicuspids and molars.

NOTE.—Cavities occurring in consequence of arrested development are not included.

CAVITY NOMENCLATURE.

This tabular presentation of cavity nomenclature is based upon Dr. Black's terminology and is intended to apply only to prepared cavities.

All that is to be said in describing cavity preparation can be expressed by the use of the following nouns and adjectives:

Cavity,	Surface,	Labial,	Mesial,	Occlusal,	Pulpal,
Wall,	Angle,	Buccal,	Distal,	Gingival,	Sub-pulpal.
Margin,	Thirds,	Lingual,	Incisal,	Axial,	
	Embrasure,	Proximal.			

Cavity Names.

ities in the teeth take the names of the surfaces in which they occur.

Cavity.
- Simple.
  - Labial,
  - Buccal,
  - Lingual,
  - Mesial,
  - Distal,
  - Occlusal.
- Complex.
  - Mesio-incisal,
  - Disto-incisal,
  - Mesio-labial,
  - Disto-labial,
  - Mesio-lingual,
  - Disto-lingual,
  - Mesio-occlusal,
  - Disto-occlusal,
  - Linguo-occlusal,
  - Bucco-occlusal,
  - Mesio-disto-occlusal.
  - (Other combinations by the same rule.)

Wall Names.

nat wall of a cavity in an axial surface of a tooth covers the pulp is called the *Axial* wall. If the ty is extended to include the pulp chamber this takes the name of the wall of the pulp chamber. bottom or floor of occlusal cavities is called the *al* wall. If extended to include the pulp cham- it becomes the ***sub-pulpal*** wall.

Wall.
- Labial,
- Buccal,
- Incisal,
- Occlusal.
- Lingual,
- Mesial,
- Distal,
- Gingival,
- Axial,
- Pulpal,
- Sub-pulpal.

ule, cavity walls take the names of the surfaces of the tooth which they oach.

Angles. (*Simple Cavities.*)

gles.
- **Line (Axial).**
  - Mesio-buccal, Mesio-lingual, Disto-buccal, Disto-lingual. — Occlusal Cavities.
  - Bucco-axial, Linguo-axial, Mesio-axial, Disto-axial. — Axial Surface Cavities.
- **Line (Pulpal).**
  - Bucco-pulpal, Linguo-pulpal, Mesio-pulpal, Disto-pulpal. — Occlusal Cavities.
  - Bucco-gingival, Linguo-gingival, Mesio-gingival, Disto-gingival, Axio-gingival (and combinations with occlusal wall). — Axial Surface Cavities.
- Point.
  - Mesio-bucco-pulpal, Disto-bucco-pulpal.
  - Mesio-linguo-pulpal, Disto-linguo-pulpal.

POINT ANGLES (the union of three line angles) take their names from the surfaces forming them. In occlusal cavities there are four.

In complex cavities on axial surfaces there is another horizontal line-angle, *i.e.*, in axial cavities combined with occlusal, the one formed by union of the axial and the pulpal wall—*axio-pulpal.*

DIVISION INTO THIRDS.

Cavities may be divided into thirds, for convenience in description, as teeth are divided.

NAMES OF MARGINS.

MARGINS.	Mesial, Distal, Buccal, Labial, Lingual, Incisal, Occlusal, Gingival.

NOMENCLATURE OF SIMPLE CAVITIES.

OCCLUSAL CAVITIES.

WALLS.	Mesial, Distal, Buccal, Lingual, Pulpal.
LINE ANGLES. (Longitudinal)	Mesio-buccal, Mesio-lingual, Disto-buccal, Disto-lingual.
LINE ANGLES. (Transverse)	Mesio-pulpal, Disto-pulpal, Linguo-pulpal, Bucco-pulpal.
*CAVO-SURFACE ANGLES.	Mesio-occlusal, Disto-occlusal, Bucco-occlusal, Linguo-occlusal.
POINT ANGLES.	Mesio-bucco-pulpal, Disto-bucco-pulpal, Mesio-linguo-pulpal, Disto-linguo-pulpal.
MARGINS.	Mesial, Distal, Buccal, Lingual.

LABIAL, BUCCAL, OR LINGUAL CAVITIES.

WALLS.	Mesial, Distal, Gingival, Occlusal or Incisal, Axial.
LINE ANGLES. (Longitudinal)	Mesio-axial, Disto-axial.
LINE ANGLES. (Transverse)	Mesio-occlusal, Disto-occlusal, Mesio-gingival, Disto-gingival, Occluso-axial, Gingivo-axial.
*CAVO-SURFACE ANGLES.	Based on the same rule as for occlusal cavities.
POINT ANGLES.	Mesio-axio-gingival, Disto-axio-gingival, Mesio-axio-occlusal, Disto-axio-occlusal.
MARGINS.	Mesial, Distal, Gingival, Occlusal or Incisal.

Simple cavities on proximal surfaces have the same number of walls,

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*Cavo-surface angle.—An angle formed by a wall of a cavity and the surface of the tooth in which the cavity is situated.

, and margins as those on other axial surfaces and are named simi-

n this basis all cavities, however complex, may be easily named and bed.

CAVITY PREPARATION AND INSTRUMENTATION.

avity preparation there are four definite steps. 1. Establish outline ity. (Outline form of Dr. Black.) 2. Remove *softened* dentin. 3. he cavity proper shape. In this step is included Dr. Black's resistance retention form, and convenience form. 4. Bevel and smooth the l wall.

t step. This includes the cleaving away of all unsupported enamel, involves the use of chisels and enamel hatchets. The extension of s, which involves the use of drills, fissure and inverted cone burs in on to the hand instruments. The extension of smooth surface cavities evention, which involves the use of round and fissure dentate burs in on to those already named.

ond step. This is necessary as soon as the cavity is opened, that the t may become aware of the extent of the cavity and avoid pulp ex- , and should be done entirely with spoon and discoid excavators.

rd step. This includes resistance form, *i.e.*, the "seat" of the filling he pulpal or gingival wall; this involves the use of the hatchet and hoe ators and fissure or inverted cone burs. The retention form or em- ing of line and point angles with the same instruments. The con- ce form or that form which enables the operator to insert the filling al with ease and certainty. As this is often simply a modification of her forms, it naturally may involve the use of all the instruments.

rth step. This includes the correction of marginal outlines, which es the use of enamel hatchets, chisels, and gingival-margin trimmers. moothing or planing of enamel-walls with the same instruments or ine burs, stones or disks.

final touches or "toilet" of the cavity which insures the operator that ready. This includes the thorough cleansing of all surfaces.

TECHNIC.

eaching typal cavity form, one of several methods may be employed:

Preparing cavities, involving the principles taught, in heroic plaster s, either by measurement or "free hand."

Preparing cavities, involving principles, in ivory or bone blocks or l teeth (either by measurement or "free hand").

The same in natural teeth.

r committee find it impracticable at this time, for many reasons, to e upon divisions five and six of the chart, and submit the foregoing he hope, that it will meet the demands of the School of Technics.

desire to acknowledge the assistance of Professors Black, Johnson, Harper in the compilation of the report.

THOS. E. WEEKS,
D. M. CATTELL,
J. A. DALE.

After reading the report, the speaker continued:

The report is submitted by your committee in the form it is that you might study it carefully and use such things in it as fit into your course. Your committee has tried where there were differences to refer to them all, and to give something that would cover each one. We did not expect that the various colleges would adopt this report in its entirety, but we hope that our labors may result in some benefit to all. We hope you will look with kindness upon the short-comings of the report, as there were some things we cannot explain that rendered it absolutely impossible to devote the time to it of which it was worthy.

EPORT OF THE COMMITTEE ON A SYLLABUS OF PROSTHETIC TECHNICS.

H. J. Goslee read the report, as follows:

tlemen of the National School of Dental Technics: Even with vantages and benefits derived from the preparation and presentation report of last year, and the very generous and wholesome discus- voked by it, together with the thought and deliberation of another time, your committee, reappointed at the last meeting, has found visable at this time to offer further suggestions toward the presenta- f an outline that might be sufficiently advanced over our last one r us any encouragement as being acceptable for your further con- ion and approval.

le no concerted effort has been put forth during the last year, each er of your committee has given the matter very liberal thought, and erable time has been devoted to the interchange of ideas, the result ch we hope may yet enable us to reach, in the evolution of things, a solution of that which seems at present to be a somewhat arduous nd a trying problem.

difficulty, of course, lies not so much in the simple outlining of a of prosthetic technics that might cover the ground and conform individual requirements, but in formulating something concise, yet ently broad and complete, to meet with the universal requirements long and short-term colleges, and be as nearly as possible in har- us accord with the variations in the amount of time devoted to this f work and the individuality of the teacher.

former report, which was a composite of the united efforts of your ittee, was presented in printed form to the members of this body the sessions of the meeting, with the hopes that they might be thus d to study it carefully, criticise it, put it to a practical test, and let ow during the interim, or at this meeting, the result of their conclu- regarding its practicability, usefulness, and value, together with any l suggestions that might occur to them.

s would prove of inestimable value to the furtherance of the work, ithout which our efforts must necessarily be primitive and some- restricted, because our endeavor in compiling the syllabus we have

had the honor to present you was simply as a suggestive measure, outlining not only the subjects to be taught, but the amount of time to be devoted to each, with a view of building a foundation upon which yourselves and your present and subsequent committees may work.

Realizing the many advantages that a suitable syllabus would offer the teacher of prosthetic technics as a guide and foundation for the systematic and uniform arrangement of the subject, and earnestly soliciting your necessary aid and co-operation in the work for the mutual benefit of this body and its further committees, this report is

Respectfully submitted,

N. S. Hoff,
Geo. H. Wilson,
H. J. Goslee,
Committee.

DENTAL PEDAGOGICS.

By A. E. WEBSTER, D.D.S., M.D., Toronto, Canada.

[T]he subject of pedagogics is a vast one. It is undoubtedly more [exte]nsive than the whole subject of dentistry. In one respect it is [simil]ar to it, being a science and an art of the last century, in fact, [we m]ay say of the last two decades. To present both the psychol[ogy] and methodology of the subject in one paper would take more [time] than is allotted to the subject on the program.

[Co]llege professors of the twentieth century will look to their [meth]ods as well as to their matter. They will be great teachers, [as w]ell as proficient scholars. The average professor in the past [cher]ished a deep contempt for methods. He counted it pre[sump]tion to call education a science, and teaching an art. But [a ma]rvelous revolution is going on. Students who elect teaching [will] be educated for their profession. College professors of the [futu]re will be as noted for their great skill in teaching as for their [grea]t learning.

[Th]e time was, when a large practice was a sufficient qualification [for] a position on the teaching staff of a dental college. Later, [and] even now, the idea prevails that knowledge of the branches [to b]e taught is all that is necessary to the equipment of the [teac]her,—that to know a thing, is to be able to teach it. One who [kno]ws how to make a beautiful piece of bridge-work is not neces[saril]y able, because of that knowledge, to teach bridge-work well. [Nor] is ability to teach made up of the subject-matter, plus knowl[edg]e of the modes of growth and the operations of the mind, but [it de]mands a thorough knowledge of mind, matter, method.

[In] the study of this subject we should expect to put forth an [effo]rt to attain the best results. We must expect to gain a knowl[edg]e of it by the same processes as our students gain a knowledge [of d]entistry. If we are the pupils of the "School of Dental Tech-

nics," as our name implies, we should work in sympathy, not expecting a very great deal from any individual, but a great deal from the whole membership. Just as we find it in those happy institutions of learning where professors and students are in perfect sympathy one with the other, having a common object, that of getting the best out of a college course. Just here I cannot refrain from the remark that in such institutions there is nothing heard about rules of conduct, nor harangues on discipline.

In a general way, what might be considered a good method of presenting a subject to a dental student, should be considered a good method of presenting a subject to this association.

Our best teachers do not believe that a stereotyped written lecture or lesson is productive of the best results, nor does the writer see why all the subjects presented before this association should be written out in full. Of course, scientific subjects are best presented in exact form, but those of a practical character are better presented according to the exigencies of the case at the time of presentation. Accordingly, the scientific portion of this paper will be read, while that portion pertaining to the art of teaching will be demonstrated.

All will agree that three terms at a dental college is too short a time to master the whole of dental science. This being true, why should we wander over the whole field without knowing whether our students are obtaining anything substantial or not? The true teacher lays such a foundation that the student is capable of filling in the details for himself, thus giving to him the pleasure of conquest. Again, the true teacher imbues his pupil with such an interest and enthusiasm in the subject, that it is studied with pleasure after he leaves college.

The great essential in all teaching is to create in the pupil an interest and enthusiasm in the subject. One of the best means to this end is by the direct method of teaching, having no hints, aids, or assistance to memory that are not allowed to the pupil. The teacher should put such energy and feeling into his teaching that the student will be carried away and the teacher in turn will feel that sympathetic touch that comes from the student. Have you ever felt it? If not, put more soul into your work.

Instruction is usually given by one of the following methods: Lecture, demonstration, Socratic, recitation, or some combination

f these. Let us briefly consider these methods and their adapta-ility to our needs as dental teachers.

By the lecture method of teaching is meant a direct continuous xposition, without the aid of demonstrations, practical exercises, uizzes, or recitations. This method is rarely strictly adhered to, xcept, perhaps, in theological colleges. Very few professional olleges of the present day depend entirely upon this method for ne instruction of their students. The demand in medical and ental colleges for more demonstrations, clinics, practical exer-ises, quizzes, and recitations is increasing. This demand is in the ight direction, and is based upon correct principles.

The lecture method has the advantage of being more rapid than ny other method of teaching, and is also adapted to the instruc-ion of large classes. The great disadvantage of this method is nat the teacher does not need to know the subject-matter, the upil, or himself. He needs little or no energy; in fact, he may ead or dictate his whole course of lectures. He may follow a rut or years, and keep his classes quiet by forcing them to take notes hich are rarely ever read afterward.

The demonstration or clinical method of teaching consists in the resenting and describing of objects, and the performing and de-cribing of procedures. Objects, drawings, models, and photo-raphs are used to advantage in this method of instruction. This is ne only true method of presenting the first lessons in a scientific ubject. Note this, object first, description immediately after, then ractical exercise. The child gets its first ideas from the sensations f touch and sight. The adult the same. Presentative ideas must recede representative ideas. After the pupil has a full stock of ensations out of which to make representative ideas, lectures and escriptions may be given without the aid of objects. To apply nis psychological principle, which should come first,—practical hemistry or theory of chemistry, practical anatomy or theory of natomy, practical histology or theory of histology, practical ma-eria medica or theory of materia medica, practical exercises in entistry or lecture of dentistry? I leave this question with you.

The demonstration method is slow, and always defective unless ollowed by practical exercises and recitations. The teacher must ave a thorough and wide knowledge of the subject, and be com-etent to do anything that he asks his pupils to do.

The recitation method should hardly be given the dignity of being named as a method of teaching. It consists in setting lessons in a text-book, which are to be learned by the student and afterward recited upon. This method is entirely obsolete in all primary schools. It is the method adopted by the old-time school-keeper. It requires the least possible amount of energy and knowledge from him. It has the great advantage of compelling the student to *work*. At the present time there is a tendency to introduce this method into dental and medical schools. One book is learned by heart and the examination is set upon it. To say the least, this is narrowing and restricting mental growth.

The Socratic method of teaching leads the pupil by judicious questioning to form new conceptions. This method has the advantage of getting the undivided attention and thought of the pupil, perfect order in the class-room, the teacher knows the exact capacity of the pupil. This method demands of the teacher a thorough and systematic knowledge of the subject, and a great deal of skill and energy in the art of questioning. He must also know either the names or numbers of his pupils. The plan of teaching the lesson must be prepared. The questioner must have a trained intellect. He should possess analytic power. One thing at a time, and it in its logical connection. Disconnected questions are the product of a muddled brain. The illogical mind cannot teach because it does not reach correct conclusions, nor does the pupil see the connection or relation one question or subject bears to the one preceding it. These demands are so great that but few teachers are following this method in our dental colleges.

By the combination method of teaching, is meant an adaptation of the method to the subject and to the capabilities and progress of the pupil. Such subjects as dental ethics and general rules of practice may be taught best by lectures, quizzes, and recitations, while anatomy, materia medica, prosthetic and operative dentistry are best taught by demonstrations, clinics, practical exercises, lectures, quizzes, and recitations. (Note the order.) Well-directed questions at proper intervals before, during, and after a lecture will arouse attention, while, at the same time, the answers will indicate to the teacher how well the subject is being comprehended. Thus there is no waste of time in lecturing upon subjects already understood, nor does the teacher lecture over the heads of his pupils.

Recitations, conducted as reviews, are very helpful to retention l to make clear ideas that were at first hazy. Practical exer-es that follow demonstrations and clinics are reviews, plus the nual training. The idea must be present before the hand can cute. Written examinations have an educational value when perly conducted. The reproduction of knowledge is a sure sign ts presence. The teacher should avail himself of every means sible to assist his pupil to gain and retain knowledge.

'sychology bears the same relation to the science of education t anatomy, physiology, and pharmacy bear to the practice of licine. It is as necessary that the teacher should know some-ig of the mind's activities as it is that the physician should w the bodily organs and their functions, their normal and ab-mal conditions.

'he teacher should be able to tell why he teaches anatomy or siology, and why he teaches them in a certain way, as the tist should be able to tell why he puts a crown on one root le he extracts another. Just as the dentist should know the cific effect of any medicine on the tissues of the body, so the cher should know the effect of a given college exercise or branch he different faculties of the mind.

BASIS OF INSTRUCTION.

a) Always base instruction upon some activity of the pupil,— interest, habit, impulse, activity.

'here must be personal or self-activity. Education is the de-pment of the psychical activities. What stimulates to activity e is not likely to do so again.

) Always base instruction upon some interest of the pupil. be interested because of sympathy, desire of progress, of wledge, or its manner of presentation. (Note what excites in-st.)

iterest is an emotion, not an intellectual act. Out of this interest ws attention.

c) Always base instruction upon some idea already existing in mind.

new idea must be lodged about an idea already there. We ays learn with what we already know. An idea (however ue) of what is to be done must precede any doing.

AIMS OF INSTRUCTION.

(*a*) Aim at making instruction significant. First make each subject, as a whole, significant; keep the whole subject in relation or bearing with what the pupil has already done in the subject.

Explain every new law, fact, or statement so that it may be translated into old perceptions.

(*b*) Aim at making instruction definite. Every lesson should have a point and every question upon that lesson should have a point, precise, salient. Unambiguous, irrelevant matter should be excluded; the teacher should avoid the introduction of confusing examples. Objects presented must plainly illustrate just the point desired. A great deal of scientific experiment and illustration is wasted because the student observes only the most attractive point. Every expression of the pupil must be definite, but the teacher must remember that ideas are at first cloudy and vague, and are only made clear by the student's mental activities being aroused to work upon them.

(*c*) Aim to make instruction practical. Instruction is practical when ideas lead to action and action is based upon ideas, that is, that it may give the student the power to act. So instruct that the student may organize his faculties and powers to develop association and attention, apperception and retention.

METHODS OF INSTRUCTION.

(*a*) Teach one thing at a time. Why?

Because (a) it economizes mental energy, (b) defines mental products, (c) excludes irrelevant material, (d) prepares the way for memory, (e) fosters the analytic habit. A well-trained mind grasps the salient points in a subject first. Teach the whole before the parts.

(*b*) Teach in a connected manner. It demands of the teacher:

1. Unity of aim or an educational ideal. Have a broad practical ideal; aim to teach correct habits of mind.

2. That the teacher be systematic. Have a definite aim for a whole term's work and carry it out in a systematic order; leave all details to existing conditions at the time of lecturing.

3. That instruction be graded,—easy to difficult, simple to complex, familiar to novel. In this connection it might be well to call attention to the too frequent condition in some of our schools

having the same class listen to the same lectures in two different rs. And what is worse, these lectures are identical for years, l in some cases, dictated, being copied verbatim by the stu-its. And what is still worse, the examination is set on what has en dictated.

A. The synthetic method demands that knowledge begin with sentation, because all representative knowledge must be capable translation into presentation. By this method, the faculties of mind are trained in the order of their development, perception, mory, imagination, reasoning. The two factors in training per-ption in order to establish a connected growth from it, are,—t, identifying the presentation with what has already been pre-ted (recognition); second, the discovery of something implied the perception, but not apparent on its surface (differentiation). New knowledge is only obtained by discovering its relation to , and the old is strengthened, extended, and developed by the v.

3. The synthetic method demands that facts be connected by laws of association, and by the relation of unity and difference, that they form centers or groups of ideas. An isolated fact is rned by the pupil only through sheer force of impressing it upon mind. In youth, this method may succeed so far as collecting umber of facts is concerned, but there is no power given to ganize new knowledge. Simply dead matter obtained after the enditure of a great deal of force. While facts are learned by ociation and relation, they serve as centers around which allied as gather, thus helping to carry others instead of having to carried by the energy of the mind.

C. The synthetic method demands that the groups of ideas thus med be used as organs for acquiring new knowledge.

First.—Old knowledge should be reviewed, grouped, and classi-l. The serial order should often be changed to the topical. e pupil should be often required to rearrange the principles of ubject.

Second.—The mind must be prepared for new ideas by stirring ideas already there, reawakening an interest and showing how se ideas lead naturally to others.

Third.—Old knowledge must be exercised and its relation to the v shown. Keep the old separated from the new and they are re-

tained with an effort, but united one assists the retention of the other.

The analytic method demands that the teacher should first present the whole, then parts; first, outlines or groups, then details; *e.g.*, a child sees a man first as a whole body, then legs and arms are made out; later, head, face, eyes, fingers, toes, and so on, until the whole detail is completed. This is the groundwork of our present methods of instruction. Our children are taught first the sentence, then the word, and then the letter. Nowadays, we frequently see children who can read well and do not know half of the alphabet. I venture the question,—Are we teaching anatomy, physiology, materia medica, and pathology correctly? Do we give our students a grasp of the whole subject first, then take up its parts and so on down to details, or are we, as in physiology, beginning with details,—*e.g.*, cell and tissues, and then giving the whole? These questions I leave for your consideration.

Studies are valuable for two reasons,—for the culture they afford, and for the use that can be made of them. In primary education, the culture a subject affords is of chief importance; while in professional education, the usefulness of the knowledge obtained from the study of a subject is of chief importance.

Grant that the subjects taught in a dental college should be useful; that usefulness does not hinder them from being valuable as a means of mental culture, if taught according to psychological principles. A subject taught contrary to the natural channels of the mind, cannot afford a means for mental growth. Anatomy is most admirably adapted to the education of perception (a faculty of very great importance to the dentist), but how can a student's perception be educated if he does not see the cadaver before he reads his "Gray"? The faculty of memory may be educated by every subject on the dental curriculum if taught according to the laws of memory. How can attention and concentration be educated if the teacher lacks the power to gain and maintain the attention of his pupil?

Physiology is well adapted to the education of the analytic habit of mind if taught properly. Hear what Professor Roark says: "A logical presentation of physiology would begin with the cell and tissues of the body and trace their combinations into organs and systems. But it would be unwise to teach the subject in that

Tissues and cells should be the last things taught." Pathol- operative and prosthetic dentistry, and orthodontia afford the est possible opportunity to educate conception, thought, nent, and reason, if taught properly in the lecture room and nary.

mpathy is the greatest governing and educating power at our nand. Where there is sympathy there is interest and all that from it. To teach well, the teacher must get very near the nt. It is impossible to get near a student without knowing and the workings of his mind. This winning of affection and dence can only be done by having sympathy for the learner s efforts and in his failures. A man that has but little sym- can never be a teacher in the best sense of the word. He be a hearer of recitations, an expositor of subjects, a martinet scipline, an enforcer of spurious attention, a prince of rule and ne, but he has no power to touch the heart. It is hard to get cit trust from students, but it is won through sympathy. In eneral management of a college it is felt, but especially in the -room where teaching is done by the interrogative method the questioner's sympathy reveal itself and win the interest of pupils. He is interested in instruction for their sakes, and become interested in it for his sake, because they have utter dence in him.

e true teacher always knows when his mind is out of contact the minds of his pupils. He has at first pitched his questions xposition too high or too low; he has failed to excite interest use he has failed to create the necessary relation between their mental experiences and the new. But he soon corrects his ; he quickly touches the responsive chord, and he feels, and the ents feel, that teacher and taught are one in thought and aim. , while the entire atmosphere of the college is one of sym- y, and thus influences the general college life, it is in actual ning, especially by the method of interrogation, that it works personal power. There is a focusing, so to speak, of the s of sympathy, just as there is a concentration of the intel- al activity in attention; in fact, the latter depends in no small ee upon the former. Under this condition, effective teaching ssible. The teacher has an insight into every mind; he adapts y question to its needs and arouses it to normal action, and

breathless interest and brightening eye prove that his labor is not in vain.

Personality is a large factor in teaching. Sympathy, we have seen, reveals itself and calls forth the sympathy of pupils, through contact and questioning. The lecturer stands afar off; he may excite admiration, but he cannot create the strong bond of sympathy which is the work of admiration and gratitude which is essential in all true education. But the sympathetic questioner works his way into the hearts of students.

Sympathy, united with enthusiasm, constitutes a powerful personality. More than anything else it is this personality that makes the successful teacher. Learning and method will be of little worth unless there is interest and enthusiasm in the work, for this alone can arouse the interest and stimulate the powers of the student. The fundamental principle is that personality communicates itself, that there is developed in the pupil the same state of intellectual and moral consciousness that marks the teacher. If a subject has no interest for a teacher, it can have no interest for the taught, but sympathy, strengthened by enthusiasm, will make the irksome or even the repellent, attractive.

In the past this association and dental faculties in general have spent much time on the: *What* should the student be taught. Now the tide has changed to, *How* should the student be taught. Lest we should be carried away by the *how*, let us *not* forget the personality of the teacher. No mechanical method can possibly be substituted for this personality. It is the power that insures clearness, force, and permanent effect to all lesson-giving. More than knowledge, it imparts love of knowledge and ability to acquire it.

In the discussion about methods, therefore, it should be remembered that the true method of the educator is not to be found among the scores of ways, plans, devices, methods that are so often enumerated; it is the method of personality. Erudition, knowledge of mind, and normal method have their place,—a high place. But the highest place must be given to personality. The most permanent influence the world has known, or perhaps will know, may be traced to its forming and transforming influence. It operates in the college with far-reaching influence. Too much reliance on methods as methods makes education mechanical, dull, deadening, benumbing, destructive of vitality in both teacher and pupil. This

to the exaggeration of the mechanical powers of the teacher ts substitution for vital power. Give the student's mind a e, do not destroy or enfeeble it by spoon-feeding, or putting place a machine which you yourself have modeled. Let the nt think for himself, and draw his own conclusions.

vish to thank Professor Hume, of Toronto University, Pro- Locke, of Chicago University, and Professor Murray Butler, lumbia College, for valuable assistance in the study of this ct.

rks read in the study of this subject: "Dewey's Psychology," chology for Teachers," by Morgan; "James's Psychology," chology, Applied to the Art of Teaching," Baldwin; "Applied ology," McLellan; "Psychology in Education," Roark; ool Management," Baldwin; "Fitch's Lectures on Teaching," cer's Lectures on Education," "Gaining and Maintaining the tion," Hughes; "Mistakes in Teaching," Hughes.

Webster, after reading a portion of his paper, illustrated his od of teaching by blackboard exercises, and also passed around g those present sections of teeth. He, in addition to the mat- ntained in the paper, said,—

this place I intend to teach one point. It is a most difficult to teach men who already know too much. What I intend ch is the shape of a pulp-chamber of an incisor in the same er I would demonstrate it before my class. The first thing is ow who the pupils are, and what they know. We expect them ow the general shape of the central incisor and the general of all the teeth; the external appearance of all the teeth. xpect them to know the crown from the root, and the general of the crown. Always teach your lesson just the way they you to. For instance, if they demand a picture on the board, ill have to make it for them.

vant you to look at the labio-lingual section, and then compare nesio-distal section at the incisal edge. But we must find out pupil has an idea of what is contained in the pulp-chamber.

Take the tooth itself, is it wider at the labio-lingual than nesio-distal (to Dr. Hoff)?

It is.

That was a bad question. You can't do these things just

as one would like to. We will follow that on. Do you notice anything about the point coming up on that labio-lingual section toward the incisal edge?

A. Yes.

Q. What is peculiar about the way that comes up? (to Dr. Darby.)

A. I don't quite comprehend the question.

Q. Certainly not, because it is a bad question. We will try it another way. In the labio-lingual section you notice it is very much narrower. Does that narrowing increase or decrease as it goes toward the incisal edge?

A. It enlarges; then it is constricted, and then it enlarges again in the specimen I have.

Q. In the labio-lingual section, does it become wider as it goes toward the incisal edge?

A. Yes, sir. It is wider than it is at the juncture of the root with the crown.

Q. How does that run up now? (after explaining.)

A. It is larger.

Q. Does it increase or decrease as it goes up?

A. It decreases.

Q. Does it markedly decrease right opposite the very edge?

A. I think it does.

Q. How would you describe that point right there? (to Dr. Johnson.)

A. The labio-lingual walls of the pulp-chamber gradually diverge and then pass rootwise.

Now, gentlemen, you know too much about these things, but if I were to ask a student he would say that it gets narrower as it goes up; in fact, it gets thin. That is the difficulty, as I told you when I started; these things don't come out the way you can develop them. Now, we have made out two points; that it is wider mesio-distally than labio-distally, and that it becomes very thin as it approaches the morsal surface.

Q. Now, the greatest diameter of the pulp-chamber is at what point? (to Dr. Morgan.)

A. Near the gingival line.

If I were in a class I would ask one, How do you find it? He would answer, and another would say, "That is not so in this case."

at once; see how many men say it is and how many say it is You see, we are educating perception.

e come to the root-canal; and what do we notice with regard to ze as we come toward the apex? (to Dr. Brophy.)

In the specimen I have there is scarcely any contraction at ntil you reach the last third of the root.

. HUNT. Mine gets smaller all the way down.

The root in general is—?

Circular.

e find that the pulp-chamber is wider mesio-distally than labio-ally; we find the root-canal is circular, and that the root of the itself is circular. What is the general relation between the -chamber and the tooth?

It approximates the former.

at is what I expect to come from the student.

If that be true of the central incisor, what are you going to f the rest?

The same rule applies.

ne point is that the pulp-chamber and the root-canal are the shape in general as the tooth itself. If I ask my students about the third molar, if he knew the anatomy of the third r he would know that of the pulp-canal.

ne student comes to us as a rule knowing nothing, we will say. n you begin to talk to him about flasks and vulcanizers and anizing, and all these things, the whole thing is a sea to him. lon't know anything about it. I know I didn't, and I didn't ny use out of the lectures for a long time after I started. The question should be to present the thing rightly before the ent. Let him see something, and then he can build in the rest elf.

DISCUSSION.

r. C. N. JOHNSON. Having in mind very vividly the resolution r. Hunt at the beginning of this session, and having respect for Publication Committee of last year, whereby an intimation was e that all discussions be prepared in advance, and, as I under-d it, written out, to the end that there would be as little time ed as possible, I have ventured to do something I have never before. I have written out my discussion.

For scope, breadth, and a general grasp of the subject the paper we have just listened to seems to me the most comprehensive of any we have ever had presented to dental teachers. It is a paper that cannot carry its full significance home to the association by a single reading. It must be studied when in print to get the most out of it, and even then there are some of its features which are so much in advance of contemporaneous thought on the subject among dental college teachers that I predict it will take years before its full significance is appreciated by everybody. A higher compliment to the essayist than this I cannot find words to convey.

The science of teaching how to teach is almost a new one to dental teachers, and it is surely time that some attention was given this subject. We are not doing our full duty to our students unless we give them the most and best that can be given them in the allotted time.

The two prime divisions of his subject seem to be the methodology and the psychology. I am a firm believer in method, but I have not yet grown to the idea that a uniform method can be taught to all teachers, or that it would be productive of the best results if it could. To carry this idea too far would be to make mere machines out of our teachers, and destroy the sublime soul of individuality. After all, it is largely the personality of the man that brings conviction home to the student, and, as the essayist has so truly intimated, no man need expect to excel as a teacher unless he be in the closest possible sympathy with his class. There is a science to teaching almost entirely distinct from other kinds of ability, and to be an able practitioner does not necessarily carry with it the equipment to teach.

The prime requisite of a teacher, as I look upon it, is the ability to stimulate thought on the part of the student and develop his reasoning faculties. So soon as you have started a student to thinking seriously on a subject, so soon have you attained the greatest measure of accomplishment toward its understanding. To this end no teaching is effective which is done in a perfunctory, cut-and-dried manner. Written lectures are simply an abomination and an offense to an intelligent class. The only aid in the lecture-room, aside from the illustrative accessories, should be confined to headings of subjects, and this merely to render the work orderly and systematic. To this end a teacher should be saturated

his subject, and no man who aspires to teach should be devoid s qualification. It requires the eye to eye contact with the to make teaching most effective. The sparks must fly from er to student, and from student to teacher, till both are keyed the highest pitch; and not till you attain this exalted condition ou doing the greatest good to your class.

ng this line, I am rapidly forcing into disfavor the practice of g notes of lectures on the part of the students; at least in the ntation of my own particular subject, operative dentistry. I o stimulate my students to think, and if there is anything I nate in college work it is the idea of students learning a thing te and repeating it like a parrot. The taking of notes inter- with the uninterrupted attention of both student and teacher. noment you lose a student's eye, that moment half your force nviction is gone. To uniformly hold the attention of a class, anner of presenting a subject must be varied; it occasionally be varied many times in the same lecture. And in this con- n the plan of having stenographic reports made of lectures lways seemed to me objectionable. The lecture which reads vhen reported is not always the most beneficial to a class, and *ontra* the lecture which carries conviction home to a class and s its indelible impress upon their minds would not by any s furnish smooth reading.

e psychological feature of teaching has more and more an bing interest to me, and I have always considered it the most ating phase of this subject; but the essayist has so ably ed upon it that I do not consider further elaboration necessary. sum up briefly, I believe that to be a successful teacher a man first of all be in love with his profession; then with his special as a teacher, and last, and to my mind most important of all, ust be in love with his students. He cannot do the most ive and permanent work without that bond of affectionate athy which the essayist referred to, where both teacher and nt are working in harmony to get the most out of a college e.

m also convinced that the element of personal integrity and l morality enters largely into the question, for I am forced to ve that unless a teacher is built up of the purest moral fiber elf he will fail to impart that particular element to his work

which makes most for the best development of his students. This view of the case gives us the most exalted sense of our responsibility as teachers, and if a man have not this in his heart he would better abandon teaching. We should also lose sight of the narrow conception which leads us to look upon this question of dental college teaching as it affects only ourselves and our students. The greatest result of our efforts relates not to the influence upon classes under our immediate instruction, but to the influence they carry with them out into the world and impart to their patrons. It is this double projection of our work that should demand of us the closest attention and the most painstaking effort.

Dr. A. H. THOMPSON. This question interests me deeply, and I think it is interesting and important to all; but there is one thing I think the paper missed, and also the discussion of Dr. Johnson, and that is the vital element of enthusiasm. It seems to me the one vital element of success in teaching is enthusiasm. In my little field I have often been impressed by the apparent amusement of some of the scholars by the enthusiasm that I would throw into the subject, but I take it as a good sign that they were impressed with the fact that I was enthusiastic. Enthusiasm becomes contagious. That is an important point.

Dr. H. A. SMITH. I want to take back some things I said this morning if we are going to have papers like this and this kind of discussion; I don't care whether it comes from the Faculties Association or any other body. In this little side talk of the essayist about asking questions I noticed how he put them. It is a very important matter, and his method is simply admirable. He didn't say "Dr. Hunt" first and then put the question, but he put the question first and then called upon Dr. Hunt to answer it; and it makes a great difference whether you adopt that method or not. It has been suggested before, and I try to adopt this method, but I am so firmly fixed in the other that I forget about it half the time. The students are not half awake, you know, and when I put the question, calling first the name, the other fellows go to sleep; so you see the advantage of this method.

The essayist seems opposed in toto to the method of reading lectures. Of course he is correct, and that reminds me of a remark of Dr. Black a year or two ago. We were talking about teaching methods in dental colleges, and he said, "So far as reading lectures

is concerned, I have abandoned all that, and each year I burn everything I had the year before, notes and all. I throw them away bodily, except some few things in the way of data and tables. I just burn the bridges behind me." I think that is the true teaching method. If you don't know the subject thoroughly, study it before you go into the class. Be full of it, as Dr. Johnson says; "be imbued with your subject." The manner of asking questions is important, and then you have something that you never had before in a paper on that particular subject.

I would like to know how they do it in Philadelphia.

Dr. E. T. Darby. I don't like to have the subject passed without a word or two of commendation for the valuable paper. There are many points in it that are extremely valuable.

I cannot agree with Dr. Smith that a man ought to destroy everything of the preceding year. I have been twenty-five years getting together my notes. I hope you will not think they are all twenty-five years old; that is, that my teaching is twenty-five years old. But there are many things that would slip a man's memory in the matter to be presented to a class unless it was tabulated and arranged in an orderly way. I have before me my book of notes, and sometimes I refer to it once or twice, perhaps three times, during a lecture; sometimes half a dozen times, because without it there is a possibility that I may overlook some important matter that will pass my memory at the time and might occur to me after the lecture was over. It refreshes my memory upon some important fact in connection with what I am endeavoring to teach. So I think notes are useful. But, as has been said, written lectures before a class of intelligent students or not intelligent would be an abomination. I can conceive of nothing more prosy than to sit and listen to a written lecture, but the personality of the lecturer would have a great deal to do perhaps with its being tolerated; some men read remarkably well. I have listened to written sermons that were a great deal better than oral ones, and I have thought sometimes a man would read his sermon better than preach extemporaneously. But I think to sit seven, eight, or nine months and listen to descriptions of filling and treating teeth, of orthodontia, or prosthetic dentistry in any form, a written description would be almost intolerable. I believe there are some teachers in our dental schools who choose that method in preference to the extemporaneous method of speech.

I have been exceedingly interested in what Dr. Webster has done in the past, and I am pleased to bear testimony to the superior way in which he presented the subject this afternoon.

Dr. Webster. I wish to thank the gentlemen who have spoken such kind words of commendation in this connection, and just want to say that the particular methods that might come out in any teaching was not in the paper at all. That was not the intention. The idea was pedagogics, and that, of course, includes psychology and pedagogics in general. The matter of questioning, for instance, might come up, and the matter of taking notes. There should be something given on that subject. As to taking notes, an abundance might be said on either side, and on the subject of questioning also. Hughes writes a whole work of probably four hundred pages on the subject of asking questions, and that might be taken up very profitably. He also writes on the subject of attention; how to gain and maintain attention, a very admirable work. These are all subservient to the general principle.

As to notes, I am a firm believer that notes are an abomination. In my own work I ask the students to put the notes behind them. In fact, I tell them I don't want notes at all, or any study on the subject at home. They may think about it, but I don't want them to go home and read notes. I feel that if I can't pound it into them there, there is something wrong. It is really what they carry away in their minds that is of importance, and not what they carry away in their note-books.

THE USE OF THE BLACKBOARD IN TECHNIC.

By A. DE WITT GRITMAN, D.D.S., Buffalo, N. Y.

There are as many ways of imparting information to others as there are senses by which we can receive instruction. We may convey knowledge by the sense of sight, feeling, smelling, hearing, or tasting. Some kinds of information are best imparted through one of these senses, and some by others. Perhaps the one most widely used is that of taste, which governs the selection of the food of many animals who are without any of the other senses.

There are methods of teaching human beings who are deprived of some one of the senses. When without sight, information is conveyed through the sense of hearing or the sense of touch, but there are cases in which an individual is deprived of the most of the senses. Laura Bridgman, for instance, was inclosed within an impenetrable wall through which there seemed no opening. She had practically but one sense, that of feeling. Hearing, smelling, taste, and sight were either wholly absent or nearly so. This seemed a case in which it was almost impossible to educate, and yet by the persistence of one man this naturally very intelligent woman became comparatively well educated and accomplished, all her knowledge having been received through the sense of touch. So extraordinarily was this cultivated that she was able after it had been awakened to form logical conclusions drawn from a mere manual or digital knowledge of an object.

In human beings probably the sense of sight has more to do with mental development than any other. It is that upon which they must chiefly rely; not only to guard against injuries, but for investigation into hidden matters. Yet the power of speech, which

appeals only to the sense of hearing, is that which was probably most early employed in the schools.

The ancient philosophers of Greece, who founded schools, and who were engaged in disseminating their doctrines, taught through the sense of hearing, their instruction being given in the form of lectures. Plato, the Athenian, founded a school of philosophy, and delivered instruction to his disciples in the groves of Academia. Aristotle was accustomed to lecture to his special students in the morning, and in the evening to a promiscuous audience in the Lyceum. Aristophanes, Diogenes, and Socrates appealed only to the sense of hearing. Although some of them wrote many books, yet their instruction was given in the form of lectures.

Modern methods of teaching are materially modified. For the very young text-books are provided and tasks must be learned, their intellect being cultivated through their sense of sight. In the kindergarten system of instruction the sense of sight is almost alone employed, the object being chiefly to cultivate a knowledge of form. In professional schools and higher universities the hearing is chiefly employed, and instruction is imparted by lectures, because it does not consist of axiomatic principles and arbitrary rules, which are the result of personal experience and experimental knowledge that cannot be embodied in any text-book. Professional instruction is continually changing with altered circumstances. No two cases in practice can ever present precisely the same conditions, and no two should ever be treated exactly alike. There is certain information which cannot possibly be conveyed by either sight or hearing alone. A union of the two becomes necessary to produce the best results. Object-lesson teaching has assumed very great importance, and is now very widely employed in almost all forms of instruction, especially where it is necessary to convey any idea in morphology. This method is adapted not only to older persons, but it appeals peculiarly to the young; and the kindergarten methods are simply a development of this form of instruction.

There are certain ideas which it is absolutely impossible adequately to teach to one who is without the proper sense, although another faculty may be so developed to take the place of that which is missing. A blind man can have no clear conception of colors, nor can a deaf man fully comprehend musical harmony.

It should be comprehended that a general education does not mean

instruction of the brain alone. Especially to a man in our profession is education of the fingers of quite as great importance as that of the intellect. There are forms of manual training which are absolutely essential to the production of any good results in many kinds of study. For instance, the pianist must go through a regular form of instruction in digital discipline, and all children may, with a great deal of propriety, be trained in manual dexterity. American dentists have probably excelled all the rest of the world in operative work, because American children and Americans generally are especially trained in many forms of technics. We find among German dentists who are graduates of the universities probably the highest development of intelligence, but as a usual thing such men are very inefficient as operators. Their brain has been educated at the expense of their fingers.

The experienced teacher can readily detect the student who has had some form of technic instruction. In the present Freshman class of the Dental Department of the University of Buffalo there are three young men who at the outset showed unusual adaptability and readiness in the use of tools and an educated mechanical sense. They seemed at once to comprehend the result that it was desired to bring about, and to know how to produce it. They handled tools dexterously, and did not seize a fine carving instrument overhand, as if it were a pickaxe. They had that flexibility of the thumb which is only found in those who are accustomed to fine mechanical work. On inquiry it was learned that the father of one of them is a blacksmith, and the boy had passed his spare hours at his father's forge. Another had been employed as a needle-grinder, while the third had spent some time in a jeweler's shop. All these three widely varied employments had alike developed the mechanical sense and the technic ability sufficiently to place them decidedly in the lead on their constructional work.

Another student has always been in school, and is a graduate from a literary college. His parents are wealthy, and there has never been any necessity for other than mental exertions on his part. This young man has picked up his oral instruction with the greatest facility, and has quite taken the lead in such studies as anatomy, while it seems almost impossible to teach him the simplest elementary principle in mechanical construction. Although he is well informed in the laws of natural philosophy, what he really

needs is a year in some employment which would develop his mechanical sense and educate his fingers.

In this country, as in most others, the digital training of women is usually confined to a very few pursuits. They become expert with the needle, but it is commonly remarked that a woman cannot drive a nail straight with a hammer. That is simply and solely because her manual training has not been in that direction. Certainly she has as much intelligence as man, but her technical work has not been the same. The boy is continually hacking something with a hatchet, or whittling out toys, or driving nails, while the girl is employed in stitching, embroidering, or in making dolls' clothes, in which she becomes expert, and which the boy would find beyond his manual capabilities.

In all the forms of manual training the sense of sight is of the very highest importance, while comparatively little can be conveyed through that of hearing. Words give no idea of morphology or of proportion, nor of the relation of one part to another. A lecture may impart definite principles upon which anything is done and the rules and laws which govern the application of those principles, but it cannot illustrate the methods of instruction. A teacher might lecture for an indefinite period upon the various forms of teeth. With most exact minutiæ he could describe the tubercles, the sulci, and the various lines without imparting to the student any clear idea of what one looks like, unless he had the object-lesson itself to show its morphology and appearance. He may even exhibit a tooth to a student and point out its various anatomical proportions, and thus convey a clear idea of what it really is; but the minuteness of the object allows him to present it to but one at a time, whereas the necessities of class teaching demand that he should be able to illustrate the same thing to a considerable number. Hence it has been usual for teachers who are instructing in tooth morphology to have large sectional models made, which may be exhibited to the sight while the lecturer is describing the various parts to the ear.

In teaching crown- and bridge-work, while a part of the instruction can be conveyed by lectures or through the sense of hearing, the main portion must necessarily be by object-lessons accompanying it, and even this involves difficulties. In making minute portions the parts are not large enough to give a clear comprehension

of them. It would be impossible for the teacher to convey the proper meaning by saying to the student that he is to make a circular band. That is very indefinite. It gives no idea of the width nor of the proportions of the band which is to be constructed. On the other hand, he may exhibit the band already made and soldered, but that precludes the possibility of explaining clearly the different steps in its construction. Besides, the band itself is too small to convey a clear conception; nor will such methods of instruction give an idea of the proportions of the different parts, nor how they are put together. If a finished crown is exhibited to a student, that gives little knowledge of the method of its construction. It is necessary to show all the different parts. Yet it is not convenient to do this at times, nor are they sufficiently large to give that clear conception which is necessary to a complete comprehension. Besides, some teachers lack that ready flow of language, that copious vocabulary of words that enables them to give a graphic idea of any mechanical construction simply to the sense of hearing. Then, too, some students do not easily and readily comprehend the fine shades of distinction upon which all real artistic results must depend.

The use of blackboard illustrations in instruction supplements the other methods, and in many cases becomes of the first importance in conveying information. There are certain advantages possessed by him who can make a clear drawing of an object that will enable him to impress himself upon students more deeply than the most eloquent lecturer. For instance, different parts in the construction of any appliance before they shall have been united may be graphically placed upon the board, and their proportions pointed out. Then a drawing illustrates the union of the first two; then the addition of more, until finally the completed object is presented to the eye.

To convey the proper idea it is sometimes necessary to exaggerate a particular part. The real, true proportions would not properly illustrate the lesson which it is desired to impart. For instance, it is desired to point out to students the difference between the typical teeth found in the lymphatic and in the nervous temperaments. This, while plainly enough perceptible to the eye in nature, would be comparatively unmarked in a model which was the exact duplicate of the teeth themselves. To convey an impression of the

difference it is necessary to exaggerate each peculiarity. This may be readily expressed upon the board.

Common defects very minute in themselves would not be made plain to the average observer in the object itself, but when a drawing of it is made and this defect exaggerated somewhat it is clearly conceived and guarded against.

There is one peculiarity in blackboard instruction which should always be borne in mind, and that is that the illustration always presents a flat surface. By showing the perspective it may be possible to give an idea of stereoscopic effects, but the picture is always a flat one. While this presents certain disadvantages, on the other hand it enables one to illustrate more perfectly an object by drawing upon a board a number of flat surfaces which, when joined together, will produce the completed object.

For instance, drawings will not at the same time present perfectly the labial and lingual sides of an incisor tooth, which a model may do, but the drawing of the labial side, when made, will more perfectly exhibit any special peculiarities through a little exaggeration of them than can any possible model. Then another drawing must be made of the lingual side, for the purpose of pointing out peculiarities on that. This necessitates two presentations, while the carved model requires but one; but each of these two, to the teacher who has the ability to draw clearly, is worth a great many models for the purpose of giving instruction.

Blackboard illustrations should always be combined with oral teaching to a certain extent. It is absolutely essential that the teacher should explain what he is doing in words which will convey his ideas. Blackboard illustrations can never be depended upon alone. They are imperfect by themselves, and require the lecture to accompany them for their full comprehension. Hence the blackboard is not a primary method of education, but it is an adjunct which supplies that which is lacking in verbal instruction.

In all forms of didactic teaching it is of the very greatest use. As I have already said, words cannot give an idea of morphology. The chalk very readily does this; but while the blackboard illustrates form, it cannot perfectly describe it. Hence the lecture and the blackboard should always be combined, and always go together. That didactic teacher who is not more or less an expert in drawing is to that extent unfitted for his position. If he is able graphically

to place before his class an illustration of his idea he will impress his lesson a hundred times more deeply upon their minds, and the perfection of the teaching will very largely depend upon the perfection of the drawing, just as perfection in lecturing depends upon the command of the proper language on the part of the lecturer.

The teacher should endeavor to address himself to as many of the senses as possible. In technic instruction this is of the highest importance. Sometimes even taste and smell are required to give a clear idea of some particular object; especially is this true in teaching materia medica. It is the odor and taste which enable one to identify certain drugs, rather than their appearance or description. But, as I have already said, it is chiefly to the senses of hearing and seeing that the instructor must address himself. The ear has no conception of form or proportion, nor is it possible to convey a clear idea of morphology by words alone. This absolutely requires the sense of sight. On the other hand, the principles, and rules, and laws which govern the construction and use of appliances cannot be conveyed through the eye. They must be addressed to the ear. Practically, then, the technic teacher is required to convey his information through the two senses of sight and hearing. I have already shown that in some instances one of these is the more important, and in some the other; that neither can be dispensed with; that a perfect idea of any appliance cannot be obtained through one sense alone, and that the judicious and sensible teacher will group together the senses and address himself to any one of them which he can conveniently reach. If one would train himself for a successful teacher he must develop his capabilities in all of these directions. If he depends solely upon words, though he possess the eloquence of a Demosthenes, he will not make a successful teacher. If, on the other hand, he depends solely on the sense of sight in his pupils, while they may have a clear idea of the form and construction of an appliance, they can have no conception of its use. They cannot understand the rules and laws which govern its construction and its employment.

A knowledge of drawing is as essential to a teacher of technics as is language. The chalk in his fingers will speak louder than the words upon his tongue. If he is deficient in either of these methods of communicating information, just to that extent is he crippled in his vocation. If it is necessary that he should study

physics and mechanical laws, it is just as essential that he should study drawing. He may not be a finished artist and he may not be a trained elocutionist, but he should know enough of both of these to be able to convey his idea through either the chalk in his fingers or the words upon his lips. Neither of these alone is sufficient, but both are essential. There are some objects concerning which one may speak for an hour without any ability to convey a clear, definite idea, when, with the chalk in his fingers, a few strokes are sufficient to express more than words can convey.

Dr. GRITMAN, before reading his paper, proceeded to show by blackboard drawings the method adopted by him in using chalk of different colors to illustrate the ideas he wished to convey.

DISCUSSION.

Dr. H. W. ARTHUR. What I have to say is what has come to me while listening to the essayist. The subject of the use of the blackboard, or in regard to the advantage of the blackboard, is one I indorse very fully, and in my limited experience I have found it exceedingly valuable. Some men have an idea that they must be artists in order to make use of the blackboard, and I think for that reason they do not probably use it as much as they should. I think we can use the blackboard to great advantage by preparing something before we go to the class. Where we have a double blackboard, we can thus anticipate the work by making the drawings beforehand, and then call the attention of the students to the point we want to draw out, and use the chalk in that way, rather than making the whole drawing before the class.

There is no question about it, no matter how clearly we express a thing in English, we do not convey the impression that we would by a drawing. We all know that. My own experience has been in going among a class after I thought I had presented the subject very clearly, and there could be no misunderstanding, I would find few who had a full comprehension of what I wanted to convey; but by the use of the board I find I have been able to convey accurately and clearly the impressions I wish to, so it would be understood.

What I have to say would be more in the line of the way I have used the blackboard. For instance, in taking up the study of form. And first the teacher ought to show that he can do what he asks them to do. So. if we are drawing, we ought to be able to show the

students we can do what we ask them to do. If we want them to carve a tooth, we ought to be able to show them that we can do it. Some students may not be able to perfect and make any and all the details of the tooth, yet they can bring out the form with sufficient perfection so that we know that they know the form of the tooth. In carving the teeth, the first thing I have them do is to make exact measurements, taking Black's "Anatomy" as a guide. Then, taking a block, I have them, with these measurements, cut out the shape. We call it "blocking out the teeth." Then they mark the outline—just a general one—of the tooth with sharp instruments.

In regard to dissecting teeth, you want to tell them how you would begin to cut the tooth. If you tell them to take a half-round file and cut just below the cervical portion, probably they will take the edge of the file and cut across the pulp-chamber or canal; but if you tell them you want to approach at that point, and show them just where you want them to cut, they will approach it right.

Then, in the matter of teaching the proportions of cavities, it just occurs to me if you want to show where the undercut should be in the dentin, it can be of great advantage. And in all these ways the chalk can be made to serve a great deal better purpose than any drawings that we may have, because we can modify it, rub out, and add; whereas we don't want to mar or destroy a drawing. For instance, we take a typical tooth, a cuspid. If we want to show how the other teeth are combinations or modifications of this, we can show, for instance, that the lateral incisor simply by removing the cusp that way we have more or less the form of the central incisor, and by combining the two cuspids we can readily see how the combination of the two cusps will make a bicuspid. In that way we can convey with a blackboard a great deal more readily than by oral expression. That is the way I have been accustomed to use it. I am sorry I am not better able to present what I have to say. That is my apology for not making it more clear to you.

Dr. N. S. Hoff. There is a method of using the blackboard that I have heard of but never used myself. It is used in the old country by those who teach histology; but, instead of using the blackboard, they use ground glass, and place underneath it the outline or form, to which they make additions with crayon on the ground glass. It has occurred to me that if our teachers in ortho-

dontia had some such method they could have behind the glass a set of teeth upon which could be put all sorts of appliances. It is very difficult to convey to students just how to adapt these appliances in the mouth for regulating purposes, and I wonder that some one has not adopted this method.

Dr. L. S. TENNEY. I have listened to the fundamental principles of teaching that have been so admirably presented by Dr. Webster, and we have had this very able paper in which the practical side has been presented to us. The longer I am engaged in teaching, the more thoroughly I am impressed with the idea that it is absolutely impossible to teach by didactic instruction only, and the more we can be assisted by models and illustrative work of this character the better success we shall have. It seems to me to be absolutely necessary that we should appeal as well to the sense of touch as of hearing. I have often wished that I was a crayon artist, and often thought that I would take lessons. We see here what a vast advantage it is to utilize this method of presenting a subject. I feel that it has been a very valuable session, and I want to compliment both the essayists on their papers.

Dr. W. H. WHITSLAR. I want to illustrate a point that the essayist suggested in his paper, that sometimes a very few strokes may illustrate a very important lesson.

(The speaker then showed by drawings the effect upon the expression of the face caused by the loss of the teeth, showing different expressions of the mouth following the loss of different teeth.)

Dr. BARRETT. An idea of form can only be conveyed by sight; hence the teacher who depends wholly on verbal or oral instruction cannot give to the students that which he should. Further, the object itself does not do it. First you have the parts, then you have the parts united. For instance, I place on the board these two lines; it conveys nothing especial, nothing that gives any idea of what it is going to be. I add another line, and you have at once a full idea of what I wish to present (illustrating on board). Hence in my own work, where the blackboard is of as little use as it could be in any branch of teaching, yet I use it a great deal. If I had skill in drawing I would be a much better teacher than I am, but with my crude ideas of drawing, with chalk in my hand, I can often present an idea very fully and bring out what I desire to present.

Dr. G. H. Wilson. I want to emphasize the idea that has been brought out by the last speaker, that it is not always necessary to have an elaborate idea of drawing in order to use the blackboard acceptably, because many times the crudest drawing will bring out an idea very nicely. For instance, if we wish to illustrate the regulation of the teeth, the student would not see the idea so clearly if we drew a perfect tooth; for with a bicuspid we have a triangular form representing the several surfaces coming together, and we show to the student that the force is always applied at right angles to the surface from which it is required, so that by drawing straight lines we make the triangle, and we can show how the force should be applied. We can do that better with the crudest drawing than with an ideal form of the tooth. Any of us can draw simple forms, and it is a wonderful assistance in teaching.

Dr. Jas. Truman. I wish simply to indorse the idea of the blackboard. It is some thirty years or more, I think, since I abandoned the use of preparing drawings, sketches, etc., to give to a class, for the reason that I would not care to present a written paper or lecture. I would not desire to bring up every year these old drawings, which the class gets perfectly tired of looking at and to which they pay no attention. If you draw upon a blackboard all that you desire to illustrate, either before the lecture or during the lecture,—but I prefer doing it always before,—you then have something that attracts attention at once, even though it may not be very artistic. I am inclined to think that methods of didactic teaching without the use of the blackboard at all are almost practically worthless. We must, as has been stated, attract the student's eye as well as his hearing, and I think it is more important to attract the eye. Now, of course, none of us can be considered artists in drawing, but I think every man with a little practice, if he is a teacher anxious and ambitious to be something, can readily acquire sufficient tact and knack to draw on the blackboard. As far as I am concerned, some lessons I had in drawing when I was quite young have served me a good purpose. Although it never made me an artist, it aided me materially in my work. I am sure every teacher ought to endeavor to do something in that line. In fact, I think drawing on the blackboard with colored chalks is more satisfactory than lantern exhibits. I have seen both and used both, but I prefer the use of the blackboard under certain conditions.

Dr. C. S. Case. This is a subject which strikes me as one of the most important things in teaching. The first thought that occurs to me is that a man should know and see in his own mind what he wants to produce. If it is a tooth, he should know the anatomy of the tooth thoroughly, and should be able to see that tooth in his own mind; it should stand out as distinctly before him as if he were looking at the tooth itself. Then he can turn it to any attitude and put the picture of it on the board, and that is all there is of it. When he can do that he is able to teach, and if he cannot do that, if he has got to draw from some stereotyped picture that he has seen, it strikes me that he is not making the best use of the blackboard or the blackboard method. Now, that has reference not only to the teeth, but to everything else. Some men are more fortunate along this line than others. I have been very fortunate in that way, and have been able to reproduce almost everything I desired, and I have found it to be one of the greatest aids in teaching. If we would talk less and show more, we would make a greater impression on our students.

Dr. S. H. Guilford. It seems to me that every teacher ought to avail himself of the various methods of teaching, whatever they may be. That is to say, we don't want to teach in a stereotyped way, and whenever illustration will aid us in any way, use it. It can be done in various ways, either by diagrams prepared or very elaborate and correct illustrations, or we can use the blackboard. We cannot convey ideas by words only; we must utilize the eye as well. In my own work I have some very elaborate drawings, anatomically correct and beautifully done, and I hang them on the wall and lecture from them. At other times I go before the class and make the drawings on the board, and I know they are very much more effective. I never knew a student to copy a ready-made drawing into a note-book, but frequently have seen drawings in the note-books.

There is another point, suggested by what Dr. Barrett said, as to making a couple of strokes to bring out what you otherwise could not do. In making a drawing, if you can associate with that some other geometrical figure or form it will be better.

What Dr. Truman said is very true, about students becoming familiar with the same figures brought before them from time to time, and they tire of them and pay no attention to them whatever.

But we should not do too much of it. As soon as the teacher's back is turned to the class, there is bedlam in the other end of the room. With the chalk in hand, never lose attention. Do a little at a time, and watch the class all the time.

Subject passed.

Adjourned to meet at Dental Hall at 6 P.M., to inspect the University of Pennsylvania and partake of a luncheon served by the Dental Faculty. After the luncheon, the president called the meeting to order in the amphitheater of Dental Hall, and requested Dr. E. C. Kirk to introduce the speaker of the evening.

MANUAL TRAINING.

Dr. E. C. Kirk. I think there is no department of our work which is more important and which will excite more interest than the subject of manual training as a means of mental qualification. We have not been pioneers in this matter. The manual training idea in general education is, as you all know, a topic or line of pedagogics which has been pretty carefully worked up. Some years ago it was my good fortune in an investigation of this subject to come in contact with a gentleman who was an enthusiast in this training. He was not only an enthusiast in general terms, but a man who exemplified in his own life the results of a proper system of manual training. I therefore take great pleasure in introducing to this audience Professor J. Liberty Tadd, of Philadelphia, who has, I think, done more than any other one man to popularize this system of education.

Professor J. Liberty Tadd. Mr. Chairman, it gives me great pleasure to speak to you on the subject of manual training in education, because I consider it of more importance than any other subject that can engage our attention, since it teaches the physical being, the mental being, and the spiritual being. Is there any work in the world comparable to the unfolding and expanding of a human mind? Teachers are builders of the city not made by hands, every stone of which is a living human soul intrusted to their care to shape or mar.

I am to speak to you on the subject of manual training; by that I do not mean just the hand, but mental training. We think with the brain, but we act with the hand. We must make the one the good, obedient servant of the other. Some one has said the hand is a projected brain, by which we direct the thought and achieve the heart purposes of man. The hand is the projected brain through which are directed the thought achievements of the heart purposes of man. I have to make a plea to-night for the development of the

hand and the eye, two of the capacities which are very greatly neglected in all the schools. I am to show you a method of work that is quite radically different from that carried on in other schools, except the one established by and sprung from the Industrial Art School. Aristotle said the hand is the instrument of the mind. It is the instrument of instruments. It is the key whereby are unlocked the potentialities of the being, and if we are to do anything for the young surely we are to give them a chance to grow into power instead of out of it. One of the saddest things in my experience is the fact that parents bring their children to me all the time unable to do anything. The hand is allowed to grow up and become adult before it is allowed to do anything. The same with the sense of sight. Some of the other capacities are cultivated up to a certain amount of training and discipline, but the sense of sight is allowed to go on as best it may. Nay, in some of the schools we actually injure sight. We shorten it, and a great deal of the joy and pleasure and usefulness is thus left out of life by neglecting the sense of sight or vision. It is the united action of the eye and mind that gives accurate observation and keen perception, sound reason and energetic action.

In a paper read by Dr. Kirk a few years ago this statement was made, which is one of the classics in manual training. He says, "The development of the mind is a natural physiological process exhibiting two phases, one of which is the acquisition of ideas through the perceptive faculties, and the other the practical arrangement of and reasoning from these acquired ideas." I might add another, which is the amount of executive volition that is generated, volition self-generated, and that is the thing we endeavor to do. Nothing is of more importance to the young than the possession of a physical being capable of making refined, delicate, accurate movements, which minister in so many ways to the welfare of the organism. Nothing is of more importance than the possession of a mental fabric built up by accurate observation, filled with clear, lucid, perceptive ideas, the result of the skillful, delicate movements. Nothing is of more importance than the possession of a spirit capable of giving an energetic impulse to the body and mind in the direction of the right and necessary. This threefold object of the work is what I wish to explain to you. It is not the subject of manual training alone. It is something more; much more. If we

are to do anything for the young in educating them, we are to give them a chance to get the joy and beauty that is blended in nature, as deep and high and broad as space. To give them a chance to enter into the heart and voice of the Almighty, speaking to them from common things of nature, things of which we see so much and know so little, before they are thrust into the grooves of business, which too often become mere ruts.

I have spoken to you of the work we are carrying on in the public Industrial Art School, an institution where I have been experimenting for over twenty years. I fortunately have been allowed to do what I pleased, and nearly the whole of the time I have been performing experiments, and I have come now to some settled facts, which I want to show you. At the beginning we tried many kinds of manual training, wood work, clay work, metal work, and a number of minor points. We have settled down to four fundamental things that I shall show to you. The entire object has been to get something that will give skill to the hand, fundamental skill; to give accurate observation, and, at the same time, through the hand to build up that fabric of ideas. The object is not only skill of the hands, but through the hand we develop the brain centers, and we actually fabricate ideas. I am accustomed to say that the hand is rooted in the mind. The work differs entirely from the work carried on in any of the schools where they have mechanical training, practicing carpenter work and various kinds of like studies. We study for the practical development of the entire organism, the hand, the eye, the mind, performing certain exercises for getting certain ends. The school offers exercises in various mediums; for some purposes soft clay and tough wood. For the purpose of gaining skill in shaping various things, we offer plants, flowers, shells, fruits, birds, etc., during the nascent period when children are most fascinated with nature forms. If we don't take them at that period they never become interested, and do not get the mental images that are so desirable. If we take them at the period when they are fascinated with natural forms, we get a different mental fabric. I will prove that the whole is a work of thought expression, just as speech is a mode of thought expression, as writing is a mode of thought expression, and as is music. If we study these methods we get ideas that will help us in our work. For instance, we know children learn to speak by making simple

ds, and then by the almighty force of habit; by repetition they e those sounds automatically, and from these sounds they made ls, and the words form sentences. We do not say that we have cy in speech until we can give the entire attention to the idea h we wish to convey. And so in writing, you may remember difficult it was to first make the rotary movements, the shaping e lines. By practice, by repetition, by the almighty force of we gradually become able to make these forms, and then p them, forming words; and from these we make sentences. we do not say we have the facility in writing ideas until we give the entire attention to the idea we wish to convey, instead the shaping of the letters. So it is with music. Some of us remember how difficult it was to make the first motor moves on the piano or violin, but by practice we become able to do st with one hand, then with the other, and then both together. the study in the world, all the genius in the world, will not le me to perform the simplest piece unless by repetition I build my mind these motor movements, so that I do not have to give ght to the position of my fingers. And the more frequent disge of energy there is back and forth from the nerve-ends to that r of the brain tract directing that movement, the better I can orm it. So it is with all our work.

ere are different kinds of expression in material, just as dift kinds of expression in drawing. You know there are many s of architecture, machinery, object drawing, and so on. There different modes of expression in wood, clay, iron, stone, etc., ll hand workers agree that there are certain fundamental prins. What are they? First, facility of the hand. No one diss the fact that this is desirable in manual training. We make automatic. Now I will point out where we are different from her schools, from the fact that we make many of these things natically with perfect facility from the start. Another thing is power to make things stand erect; to feel horizontal lines or cal lines. Then another thing is to be able to feel balances; an natic power to feel one side equal to the other; to be able to fitness; to be able to grasp magnitudes. The moment we can proportion and grasp it through the hand instantly, automatic- we have power. That is the fundamental principle of the I shall explain. Let me illustrate. I shall use the simplest

marks we have in the kindergarten, and I shall show you a class room with the children at this work.

I am going to make a circle (stepping to the blackboard and illustrating). It is the first time I have done it, and you notice my hand shakes. I am a little nervous, you see, but by practice, by repetition, I get so I can swing my hand without any trembling. Of course I am speaking of children five or six years old. By practice, by swinging the hand continually, we gradually get power to make that movement with facility. The same with the left hand (illustrating). At first it will be difficult, but by practice we get so that we can swing the hand freely; and then with both hands (illustrating); then reversing; then to the right; then to the left, each one of the movements being a new physical co-ordination. We never give more than five minutes at a time, but we make every possible physical co-ordination that is possible on a flat surface.

This is another one (all these remarks are accompanied with illustrations), a little more difficult you see, making hand go in different directions. We have large classes in the feeble-minded institution at Media. We found they could do this work of co-ordination, and beautiful work is the result. In a very few seconds, never more than three or four seconds, almost any co-ordination can be made. Let me show you straight lines. I shall scribble because I want to show you so much. Each form is made with both hands. For instance, I am making this; by repetition I become able to swing my hands freely, no trembling at all. It is done automatically; that is what we aim for. We don't seek for accuracy; we seek facility, and then accuracy. In doing this I am gradually becoming able to ~~feel~~ form and movement, until I get perfect dexterity. I shall not make each form, because I want to show you so much. Each one we make in all directions, and get every possible movement on a flat surface; and the same thing in soft clay, and the same in tough wood. We have many of these forms that we make in various directions. Now, very quick, I wish to show you some of these forms, based on the thought that they are made automatically. I am purposely drawing these very rapidly to show that they are made automatically. Of course, if I took a little more time I could make them better. Now you see the range. We take any design and make it automatically first, and then see the range of possibilities. Every one gets the power

ıake the same thing in soft clay, and then in tough wood; and can see at once the co-ordination; not only on the flat surface, in soft clay and tough wood. If I take up this chisel I am re- ed to be able to cut right and left; the same with this gauge, ıst be able to push or pull on both sides; the same with the et. You never heard of an engraver using one hand. All otors work with both hands. We must feel the wood through hisel, if it is two feet long or three feet, just as if I was touch- t with my finger; actually drawing in wood as we draw on the kboard, just as we draw in clay and wood. Wood has a cer- amount of texture which resists in some places, as the grain across or straight. We have to work four ways in going nd a circle in carving. I am speaking now of carving, because nsider it of such great value to be able to cut out form by king form; to be able to project the thought and then cut out the ı in the wood. In this way I can measure force. I can put a pressure of fifty pounds by pushing with this and holding with the other. These movements are especially appropriate nanual skill in a certain amount of physical co-ordination. With e exercises we have this automatic power to be able to grasp ı in any medium, in wood, clay, ivory, or metal; to be able to form. There is always one point of the circle where the hand find it a little more difficult. In making that I have made a le curve all around the circle edge. I have the power to go nd make the greatest variety of forms. You can see at once automatic. This time it is more complex. I begrudge the of these diagrams because I want to show some of the children ork, but I can go up to the most elaborate forms that are used t, each form being drawn free-hand and made automatically. ı the children in this work we have three mediums, the black- d or paper, then in soft clay, and then in tough wood. The ren are compelled to remember and recollect the images. We t care how crude they are, but we get wonderful results.

hall show one or two of the boys' work before I show anything These are boys from the Catholic High School. I have ge of the public Industrial Art School, where we take care of undred and sixty children. Each week they receive two hours. ndeavor has been to get the greatest amount of manual training ble for the large number. (Three boys about sixteen years of

age were sent to the blackboard and told to draw what they wished.) Notice that the movements are automatic; the boys can do the same thing in clay or wood. I want them to hasten, because my time is limited. Now, remember, these boys can think form of any kind, and they can draw all day long and the pattern will be different. Of course they will draw other forms, geometric, or constructive, or natural forms. These forms show a certain amount of balance and proportion, and you see the endless variety that can be made. Most people in drawing must keep a piece of rubber in one hand and rub out half they do. Our children think form; not only form on a flat surface, but also in tough wood or soft clay. I want you to get the idea that we have automatic power in this work; that they don't have to give attention to the movement of the hands. The forms they are making are simply projected ideas.

Some people might say these forms are not correct. The Greeks were the greatest draughtsmen of whom we have any knowledge, and they never made a correct form. They never made two sides of one pattern absolutely alike. There was always enough difference to show that it was hand-made. These boys have worked four or five years, and are through the high school now. We are working a little too quickly, because I want to show you so much and have so little time.

Now I shall show you some of the drill forms. Understand, we give these forms to small children. It is better than a great deal of the kindergarten work carried on, because it makes use of the free-hand, arm, and spine movement. There is a great deal of wrong in the kindergarten system, because they use the fine centers too soon. They do paper cutting and stick pins in holes, etc. I believe in the spirit, but not in the act of kindergarten teaching. We have lots of children that make perfect circles, swinging the hands one way, and then the other. How do we get nature forms? How do we get natural forms? Let me illustrate. I have a large class of children, and I say to them,—we take one or two hundred at a time,—and I say let us draw a horse or a man. Some say they can't make a straight line. If I ask a lot of children to draw a man, they make something that gives the idea of a figure. If I ask them to make an animal, they make perhaps a body and tail and four legs. We can't tell what kind of an animal it is, but it gives an idea. If you have ever made a diagram of anything, no matter

›w crude, you can hardly forget it. The point I want to make is at in making these things we use the muscular sense, and we lock e idea in the mind permanently. Now I am going to make a ry rough diagram. I am thinking a bird with a long neck; here am thinking a bird with a short neck, and here I am simply putig down certain mind impressions. The same if I think any her form. No one can draw and delineate a simple form withit making a more vivid impression. We help the mental faculs; we do fabricate ideas.

There is nothing of more importance in education than a power get accurate observation and keen perception, sound reason and ergetic action. It comes through these three modes of work, d I claim there is nothing will energize the organism more than ing this work. While getting power to discharge energy through e nerve-ends by these movements, we energize the centers of the ain. It is during the period of youth that we must do this if we sh to get good results; this superabundant energy that children e so filled with that must be directed in these channels. It is rown away now and wasted in many cases. Too often in the hools we consider printed, written, and spoken words instead of al things. I would make a plea for more time to be taken from ok studies and given to the realities. I have a shell in my pocket, stone, a flower; anything would do, form, color, etc. It is bristng with ideas; it is teeming with facts. Is it unreasonable to pect that the pupils that are getting an education should become le to focalize these facts? I claim we should get them so they can stantly respond to any natural form. I ought to be able to give ty under each head, and then all the abstract facts. That is not reasonable, and in doing this work we do get mental fabric. iat is quite different from that where they assimilate only printed, itten, and spoken words. Every natural object teems with someing that is wonderful in form, color, texture, and the study of em creates expansion of physical knowledge, mental knowledge, d spiritual knowledge. If God speaks at all,—and who doubts at he does?—he speaks through his works. Morrison says we e to bend to the persuasion that is flowing to us from every tural thing. Shakespeare says there are

> "Books in running brooks, sermons in stones,
> And good in everything."

Now I shall show the boys again drawing some natural forms, and then I want to show the work on the screen. These boys will not only make one form, but will make it in any position. You know a great deal of time is lost in school by memorizing. We use this work in all the studies, anatomy, botany, geology, zoology, and we lock the facts into the mind through the sense of touch. In one case energy is consumed, in the other it is conserved. Of course, you can see these boys are feeling a certain amount of form. Some one has said that genius is the power of co-relating innumerable memories. These diagrams illustrate how we get the technical names. By means of diagrams we lock the ideas in the mind. I make a diagram of a fish and put the technical names to it, and it is retained in the memory; for we use the sense of touch, and then we make an impression that is permanent and abiding.

(Lantern slides were then exhibited, showing the interior of different school rooms and the work done by the students in the different institutions.)

At the close of the address it was moved that a vote of thanks be extended to the lecturer for his most interesting and instructive lecture.

Dr. E. C. KIRK. I feel there is no time at our disposal to discuss this matter, but I wish to say a word, to raise this thought in the minds of those present, if it has not already occurred, and that is the significance of this course of preliminary training as one suitable for the students preparing to enter upon dental studies. It seems to me if our students could receive a course in manual training, we would have a much more satisfactory foundation upon which to build the superstructure of dental education.

A MEMBER. Is it feasible for adults to attempt work of this kind? Is it not designed to begin with children rather than at adult life? Do adults ever attain any great degree of proficiency?

Professor TADD. Of course physical co-ordinations and mental co-ordinations can be made better in youth, but I find people of sixty years of age can do this. We have plenty of them. We have large classes of public school teachers. Of course, it is more difficult to make a man learn writing at forty years of age, but he can always become able to write; so I claim I can make a man of forty or sixty do this work. This does not require genius; we make capacity by the repetition of certain deeds. We have feeble-minded people who

this work. Sometimes pupils who have the least power in the inning do the best; those who start very brilliantly sometimes not equal the others.

especially feel it is desirable for dentists, doctors, and surgeons, ause it teaches ambidexterity. I have taken graduates from e of the greatest institutions of this country, Stevens Institute Technology, the Boston School of Technology, and others. I e found that they have a certain amount of power in certain ctions, but they do not have manual skill as I mean it. They 't have this automatic power to feel form, to recollect and revive tal images. That is what we claim is most valuable, to memo- and feel form. I have suffered at the hands of dentists; not in country, but in Canada. I had a man chisel in a cavity, he ed it; it was really a cave or cavern in one of my teeth. He ld push and could not inhibit. You know what that means. could not inhibit his touch. He would jab the drill into my very frequently. I felt that that man did not have manual ning. He needed a certain amount of power to retard his touch, eel form. By working in these three forms we get that power remarkable degree.

r. W. C. BARRETT. It is necessary for the dentist to have his d educated as well as his head, but life is too short for the ner education. We want fifteen years for educating the brain fifteen years for educating the hand, and where would you draw line between the two, as to which shall not overlap the other; t is the most appropriate point at which to stop the education of brain and the education of the hand? That is the practical nt that comes home to us.

THE USE OF THE LANTERN IN TEACHING.

Dr. M. H. CRYER, of Philadelphia, gave a lecture on this subject, using the lantern and projecting microscope.

Dr. Cryer maintained that the projecting lantern with good photographic slides furnished a mode of lecture illustration second only in value to demonstrations upon models or actual cases. The use of models, charts, etc., was of less value in that these modes of illustration could not be satisfactorily used for large classes, whereas a photograph projected upon the screen was visible to all at the same moment.

Professor Stellwagen was among the first dental teachers in Philadelphia to use the lantern, and in histological work especially he advocated the projecting microscope, using the actual section of tissue rather than a photograph to avoid photographic errors and secure a picture on the screen giving the elements of the tissue in the normal colors of the stained specimen. Until recently a satisfactory projecting apparatus for microscopical sections has not been available, but we now have an improved apparatus which gives thoroughly good results, as will be demonstrated.

A well selected and properly arranged set of slides makes the most satisfactory lecture notes available, relieving the teacher from the burden of preparing a written discourse or copious notes.

Further development of projecting apparatus should in the future enable us to throw upon the screen images of operations in progress and of solid objects without previously photographing them. The biograph or some modification of it will undoubtedly be brought into requisition for lecture illustration when the defects of the present apparatus have been eliminated and its cost reduced. While the electric arc light is the best illuminant and the cheapest at our disposal, the varieties of apparatus and illuminants are so considerable that any teaching institution, whether equipped with electric current or not, may now secure satisfactory projecting apparatus well adapted for the purpose.

ne use of many pictures should be avoided. They should be oduced to illustrate the points upon which instruction is given, not be shown as an exhibition of pictures to supply the lack rains or teaching ability upon the part of the lecturer.

collection of slides made from the several dental schools of adelphia was then thrown upon the screen. They covered the le range of subjects included in the dental curriculum.

r. F. D. WEISSE. I am very glad to be present at this exhibi- I commenced using the lantern for lecturing twenty-five s ago, and I have been using it ever since. I have preached value of the lantern ever since that time, and it gives me great sure to see and listen to this demonstration of the possibilities ne lantern as a means of showing to large classes what we have o. I think those of us who attended college twenty-five or y years ago remember well how a skull was passed around, as Cryer describes; and the professor would go around the three ons, right, and left, and middle.

here is no department of education where the lantern cannot nade useful. As Dr. Cryer says, there is no department of icine, dental or general medicine; there is no department of ning in which the lantern cannot be used to the greatest possible ntage. No educational institution is properly equipped that is supplied with the facilities of lantern illustration. They can be y kept, and the slides are cheap, sixty cents each.

my early experience I used an oxyhydrogen light for years. rward I had a battery made strong enough to use electric light. t was before we had electricity as it is used to-day. For the six or seven years we have been using the double electric arc t, and we find it perfection.

nother point in using the lantern. I have found it most satis- ory not to give them too many pictures at one time. I never v more than one picture at a time to be exhibited to a class. cribe that thoroughly, and then pass on to the next; that is, in g pictures or cards. This idea we get to perfection with the ern. I think no one can as effectually communicate his ideas out illustrations as he can with them, and the lantern is a very able means of making these illustrations.

ORTHOPEDIC TECHNICS.

By C. S. CASE, M.D., D.D.S., Chicago, Ill.

(Before commencing to read the paper, Dr. Case passed around among those present a card to which were attached different specimens of bands and wires, to which he referred in his address.)

In accepting the invitation to present at this meeting a syllabus for the teaching of technics in orthodontia, permit me to say at the outset that I do so with no ambition to exploit personal ideas or advocate any one man's system of practice, but rather with the hope that we may unite in our efforts to upbuild this department and make it a worthy branch of a noble profession.

To accomplish this most effectually it is important that we unite upon some common ground of understanding as to its importance, its possibilities, and its needs. With this as a foundation it will not be difficult to construct a syllabus that will be mutually acceptable and advantageous to all who desire that this branch shall be taught in the most practical and sufficiently thorough manner.

Whatever the seeming differences in *modus operandi* among advanced teachers of orthopedic dentistry, I believe the general trend is toward scientific principles and practice, with the gradual elimination of methods that have encumbered the advancement of this department in the past.

I believe it is quite generally accepted and taught that teeth can be slowly and safely moved under limited conditions of age and healthfulness to relatively new and permanent positions, and that such movement is susceptible of being accomplished exactly in accord with mechanical application of force and in keeping with its action when applied to other things in mechanics. Further, that

e can be so applied to the teeth under favoring conditions that roots and adjoining alveolar process will be carried bodily in direction of its movement, even to influencing to a limited nt the development and future shape of the maxillæ.

[oreover, I believe the statement will not be controverted that esthetic phase of the operation of dental regulation is, with rare ptions, by far the most important part of the undertaking; and this beautifying effect is not confined to the appearance of the 1 alone when exposed, but may be made to extend its influence l that area of the physiognomy which is dependent for its con- upon the teeth and bones that are susceptible of being changed ieir relative positions and shape by orthopedic processes.

hese facts, with their broadening influence, increasing the field ur accomplishments and future possibilities in this department, g us as teachers properly to the consideration of the question, the science of regulating teeth attained a stable position of cient importance to the profession of dentistry to induce this 7 to co-operate in teaching it as other branches of dentistry are ht, with a thoroughness in every detail that conserves to the est accomplishments of the art?

1 attempting to give in detail the course which I endeavor to h in the purely technic branch of this department, I fear I shall unter many objectors to its extent, etc., who believe that the culties to be encountered in what they are pleased to term the ble regulation of teeth do not warrant the occupation of so much for training students in the mechanical construction of imple- ts, stock material, and appliances, which can as well be pur- ed, etc.; while others will claim that I go into the work too ly, or pursue a course which students cannot successfully fol- —that there are other ways much more simple, etc.

know one dentist who accomplishes pleasing results in the lation of teeth with silk ligatures alone; another with thin rib- of pure gold; others with rubber plates, etc.; but that does not r me from believing their accomplishments are quite limited n compared to those of more thorough methods, founded upon ntific principles.

1 my opinion there is no royal road to the highest success in or any other department of dentistry. And, while I do not me that we have more than begun to approach the highest suc-

cess of this department, or that I am more successful in my efforts than others who with me are earnestly striving for its greatest attainments, and whose methods may differ decidedly from mine, I can but strive for the teaching of those principles which experience has taught me will accomplish the results aimed at in the most perfect and efficient manner.

My practice and teaching in the technic branch of the work is founded upon the principle of applying force, almost exclusively, through the medium of attachments soldered to bands fitted and cemented to the crowns of teeth.

While there are many other ways by which the most satisfactory results have been attained, and which I am not here to criticise, I believe there is no other way that will afford the same opportunities for applying force for the movement of a tooth, on the one hand, in every conceivable direction, and on the other for the non-movement of teeth grasped by stationary anchorages and retaining appliances, to say nothing of many other advantages which it and the system dependent upon it affords.

The reason I here lay so much stress upon the band is because upon it, in its completest sense, depends the very character of principles I attempt to teach, which is no man's specialized system, to be followed by rote, but in my opinion a foundation almost limitless in its possibilities for the development of individual ingenuity, —that keynote to successful practice in this department. While the principle of banding teeth is not new, I contend that it is not commonly taught or practiced in a manner to obtain its fullest usefulness. I therefore feel called upon to make a plea for the band to start with, with the hope that we may agree upon this as a common ground to shape the character of our orthopedic technics. In the same way that you as a body of teachers, after deciding upon gold as the only filling-material for certain cavities, because you see in it certain results that cannot be attained in a like degree with anything else, you proceed in your methods of teaching to thoroughly develop every principle in consonance with its use,—principles, moreover, that have originated through the medium of its possibilities.

I do not mean by "bands" any thin, narrow ribbon or bands of variable quality and adaptability that may be cemented to the crowns of the teeth. And certainly not those that are looped around

uncemented to one or more teeth, nor those that are supplied attachments, however ingenious, intended for the purpose of ding proper fitting and soldering, those saddest of commentaries the inability of dentists to perform one of the simplest opera-; but I mean bands that possess the special qualifications—erties, thickness, width, position, etc.—to meet the demands of particular force that is to be applied.

have found no other material that combines so many of the rable properties as high-grade German silver for every part of a al regulating apparatus, with an occasional exception. German silver, as you know, is an alloy of copper and zinc, or brass, the addition of nickel. Some manufacturers add a small percentage of aluminum and iron.

is difficult, if not impossible, to obtain German silver from a er that is fit for immediate use in the construction of a regulating appliance. Manufacturers do not supply to the trade German r wire above eighteen per cent. (which means eighteen per nickel) except for specially large orders.

my experimentation I have found the twenty-five per cent. e far superior in every way to the eighteen per cent. Besides natural properties of flexibility, ductility, strength, etc., the er grade is especially susceptible under proper manipulation eing made exceedingly rigid, a desirable property for jack and ion bars. With further drawing it is nearly as resilient as pered steel, a property necessary for rotating and alignment s, spring expanders, contractors, etc. Again, it can be made ciently soft and pliable to permit the most accurate adaptation. s high fusibility permits the use of any of the gold or silver ers. Its deleterious influences as a metal in the mouth, for the t time it is worn, are no greater than gold. The danger in this icular lies far more in loose methods of construction and attachment of the apparatus, preventing the dislodgment of decomposing tus. Its appearance when compared to gold is a real objection, even this is largely obviated by electro-plating, followed by per-cleanliness in the mouth. Its cheapness is greatly in its favor, nitting, in infirmary practice, the lavish use and destruction of erial for every appliance desirable, at a very small fee.

ven in private practice the influence of its cheapness is toward employment of more original and scientific methods. There

will not be the same tendency to use certain stock material or parts of apparatus that you happen to have on hand with a very questionable endeavor to make them do, as you might if they were gold. Nor will you hesitate to cut away and remove apparatus or parts the action of which is found to be inadequate or not as anticipated, or that which the progress of the case has outgrown, with the view of substituting others better calculated to meet the demands.

Before taking up the technic work in detail I wish to speak of some of the difficulties we have encountered heretofore, especially in the teaching of this branch, and to suggest remedies.

We have always experienced difficulties in obtaining proper draw-plates and screw-plates that would enable students to draw wire to the several sizes desired, and to the exact diameters requisite for cutting full and perfect threads with a Martin screw-plate. The reason for this is that there is at present no exact standard of uniformity in the sizes of the holes of different draw-plates marked with the same letter, nor is there a harmonious relation in the graduation of the holes.

Draw-plates being made to merely reduce the sizes of wire within the range of their several fields of capacity, there is also no relation whatever between the sizes of its holes and the sizes of wire required for perfect threading in any of the screw-plates. This is true also of any of the standard gauge sizes.

Students in drawing wire through an ordinary draw-plate frequently find that when drawn through one hole it is too large, and if drawn through the next in size it is too small. This demands the enlargement of the smaller hole with emery strips; in fact, the readjustment of a number of holes in the draw-plate to the required sizes of the screw-plate in use.

Again, when drawing wire, on approaching the particular size required, students are obliged to have frequent recourse to a micrometer caliper, as the standard slot gauges, as I have said, do not measure the sizes required by the Martin or any screw-plate. As the caliper is an expensive instrument, the one owned by the demonstrator or the college has to do for the whole class, a fact that often occasions considerable delay in large classes.

Again, in making tubing with the ordinary draw-plates it is necessary to have an extra draw-plate with holes much larger in size, in order to obtain the use of the two or three large holes required to

and approximate the joints previous to reducing the tubes in :egular graduated holes.

:everal years ago I originated the idea of inserting in one end ie regular draw-plates three extra holes for this purpose, since :h time these have been in market and have subserved a good ose, but they are far from perfect in this and other particulars. the Martin screw-plate we have fortunately found a standard zes; that is, screw-cutting holes of any number are intended ie manufacturer to be exactly the same size in every plate of the : letter, regardless of differences in other particulars. I have d, however, that different batches of screw-plates will often r in this particular, so much that a nut threaded with a tap : in one plate is unfit to use on a wire threaded in another.

hen it is remembered that the height of a thread on the smaller vs is but .003 of an inch, you can appreciate the difficulty of enting the slight difference that would cause a misfit, especially 1 you also remember that .003 of an inch, or No. 40 B. & S. e, is the thickness of thin writing paper. Nor is this differ- material when the tap for threading the nut and the wire upon h it is to be screwed is cut, as it should be, in the same screw- . It, however, explains a common trouble which dentists rience who are forced to depend upon store taps or nuts that been made by the use of a different plate than the one they o thread their wires, and it is also one of the many arguments vor of technic training.

iother difficulty arises in the frequent breaking of the steel taps : they are being threaded, especially by beginners. This is argely to the fact that with a screw-plate even so perfect as the in the complete thread must be cut practically in one hole, ise the two holes under one number in any of the present screw- s are nearly or quite the same size; the difference, being so t, is of no practical advantage.

ie operation of cutting a complete thread at once requires thing more than the greatest care to prevent the necessary n from breaking the steel shanks of the smaller taps. This is true of the smaller regulating wires when they are drawn to a temper and sufficiently large for a full thread. It may be ested that we begin the cutting in some of the larger holes, and thread thus partially cut could be safely completed in the

required one. In fact, a very good teacher once told me that he so instructed his class. He was probably not aware that holes of different numbers differ in the number of threads per inch, as well as in size. Consequently it is not correct practice to start to thread a screw in the No. 4 hole, for instance, that is intended to be finished in the No. 7, for obvious reasons.

All these difficulties which I have enumerated in the use of the present draw- and screw-plates we now hope to completely obviate by the use of new plates at present in course of manufacture, which will be specially constructed to meet the needs of this particular department.

The new "dental gauge draw-plate" (see Fig. 1) will contain all and only the draw-holes we require. Moreover, they will be cut as regards size to strike an unbroken series of standard American (B. & S.) gauge sizes, and the official numbers of the same will be stamped adjoining their respective holes. Intervening gradation holes between these sizes will be unnumbered. Wire being drawn with this plate will not require a gauge to determine its size. The plate will also possess the three extra holes for starting tubing. These will be regularly constructed draw-holes, in size Nos. 5, 6, and 7. The graduated draw-hole series will commence at No. 8 and end at No. 24. These plates are also intended to contain five ovoid flattened D holes for drawing hook and reinforcement wires, which will be of far more practical shape than the ordinary D wires.

The new "dental screw- and gauge-plate" (see Fig. 2) will have along its edges a broken series of standard American (B. & S.) gauge slots for measuring only those sizes we require of wire, plate, and banding material. The official numbers of the sizes will be stamped in the plate adjoining their respective slots.

As a special feature of the plate, the screw-cutting holes will be specially constructed for perfectly threading the standard American gauge sizes of wire which we need for the work. Each pair of holes for making one screw will be placed on a line with and under the number of the gauge slot, which measures the wire they are intended to thread. Of these holes one will cut no more than two-thirds of a complete thread; the other will finish it, a feature which we hope will effectually prevent the future breaking of taps and small wires.

One of the many advantages of this system, which reduces all

FIG. 1.

FIG. 2.

FIG. 3.

our sizes to a single standard, is that we will avoid the confusing necessity of designating these sizes in our teaching; at one time according to B. & S. gauge, at another according to the number of hole in the Martin screw-plate, and again in the thousandth of an inch.

When once established, all sizes of wire, tubing, nuts, screws, plate, and banding material will be designated by the simple use of name and number.

I have thus fully described these plates and their comparative advantages; not alone because I believe they will mark an era in the advancement of orthopedic technics, but more especially to simplify my description of the laboratory work which will be founded upon their use.

By referring to Fig. 2, which represents a face view of the "screw-and gauge-plate," the eight gauge slots on the right, with their respective numbers from 13 to 23, inclusive, designate all the special sizes of wire used for regulating, and which the adjoining screw-cutting holes are designed to thread; while the eleven gauge slots on the left of the plate, with their respective numbers from 24 to 40, inclusive, designate all the different thicknesses of plate and banding material.

In presenting a syllabus for the teaching of orthopedic technics I can do no better than describe in detail the course pursued at the Chicago College of Dental Surgery, which is similar, with slight variations, to that at the Western Reserve Dental College.

The course is confined to the first four months of the junior year, and occupies two half-days of each week.

It consists in the construction of implements for technic use, stock material, and technic regulating apparatuses.

The implements and stock material, when finished, are neatly mounted on cards of uniform size, furnished by the college, and marked with the name of student and number of section, to be turned in for grading.

This material is intended to be distributed to tabulated boxes, containing "college regulating stock material," and ultimately to be used for practical cases by the seniors. We have found this feature of the greatest importance in obviating the difficulty of obtaining and having in college stock proper regulating material.

The technic regulating apparatus of the course consists in the

struction of one of sixteen standard regulating apparatuses, ch are intended to cover all the ordinary demands for the regula- of teeth. Large working drawings of each of these are framed hung in the laboratory. Students are also furnished with blue ts drawn on a smaller scale.

he apparatus, when finished, is gold-plated and mounted, with ect plaster models, upper, lower, and occlusal, in a specially pared box furnished by the college, and marked with name and ion ready for grading. This box with its contents is returned he student at the close of the senior year.

efore beginning the work the class is divided in alphabetical er into sixteen sections, or according to the number of technic ulating apparatuses they are to construct. Each student then ws at once what apparatus he will be required to make by com- ng the number of his section to those of the working drawings. eneath each drawing will be found the name of the apparatus he character of the irregularity it is intended to correct; also sizes of all the material to be used, and special directions rela- to its construction not shown by the drawing, though, as may een, it gives several views of parts difficult to understand.

he present drawings, as shown by the blue prints here pre- ed, will be replaced in the coming year with others more sys- atically arranged, and bearing designations according to the system of sizes.

s it would be too much to expect every student to make all the k material required, it is divided among the sections in propor- to the needs of instruction and the probable demands in practi- senior work.

show you a laboratory chart with stock material attached, ch designates the requirements of each section. From this it be seen that, besides the technic apparatus of the section, each lent is required to make one drill, one tap, and one wrench; two ting wires, five inches long, Nos. 22 and 23, each carrying four es rotating tubing to fit; two D wires five inches long; one No. ack-screw, with tube and nut; one No. 18 traction screw, with and nut; one No. 18 reciprocating jack and traction screw; prepared rotating wires, ready for adjustment; three prepared ks, different styles; one roll waxed separating tape.

n connection with the above, Section 1 makes four five-inch

pieces No. 13 wire, threaded one-half inch at one end, each piece bearing two nuts, and four inches of tubing to loosely fit; also two rolls banding material, two widths, No. 40.

Section 2 makes No. 14 wire, tubing, and nuts; otherwise same as above.

Sections 3 and 4, No. 16 wire, etc., and No. 39 banding material, as above.

Sections 5 and 6, No. 18 wire, etc., and No. 39 banding material.

Sections 7, 8, and 9, No. 19 wire, etc., and No. 38 banding material.

Sections 10, 11, and 12, No. 20 wire, etc., and No. 38 banding material.

Sections 13, 14, 15, and 16, No. 22 wire, etc., and No. 36 banding material, excepting that Section 16 makes No. 34 banding material.

All wires used for constructing regulating appliances are drawn ***without annealing*** from "hard" German silver wire, No. 9, the object being to obtain wires of a temper that will best subserve the objects of its uses, and exactly the right size to permit the cutting of a full and perfect thread in the screw-plates; two objects that cannot at present be attained by wires purchased of dealers.

The No. 9 wire is issued to the students in pieces sufficiently long for the requirements of each. These are tapered at one end to enter the draw-holes and be grasped by the draw-tongs. The force required to draw these large wires is so great that it is necessary to use an apparatus similar to a jeweler's draw-bench, rigged with windlass and crank.

The drawing of German silver wire adds greatly to its rigidity and resiliency. When hard No. 9 is reduced to Nos. 13 and 14, perfect material is produced from which contouring power-bows can be constructed that possess all the requisite properties. When further reduced and hardened we obtain at Nos. 16 and 18 the requisite properties for jack and traction screw bars. At Nos. 19, 20, and 22 traction and alignment wires, and No. 23 the smallest rotating wire.

The rigidity and strength of these very small wires drawn in this way, and the force which they exert when properly adjusted, cannot be fully appreciated till tested.

When the technic wire is drawn and its size tested in the slot of the screw and gauge plate, it is cut into four pieces five inches long,

e end of which is then threaded one-half inch, and the extreme int abruptly tapered ready for the nut and final mounting.

The tubing is made of German silver plate, No. 28, excepting the ating tubing, which is made of banding material, No. 37. The te is cut into strips three-eighths of an inch wide and eighteen hes long, one piece being considered sufficient for the require-nts of each student. The strip is first thoroughly annealed, then rtially turned by laying it over a groove cut in a hard piece of od, driving it down by the aid of a steel rod laid lengthwise upon One end is slightly tapered and solidly rolled to a grasping nt by lapping the surfaces. Then it is drawn to loosely fit the rticular size of wire for which it is intended, as has been fully scribed.

The rotating tubing is drawn to exactly fit the rotating wires. ien drawn, the tubing is cut in four pieces four inches long, and pped on their respective wires.

The difficulties attending the proper construction of nuts have, re than anything else, proven a great stumbling block to the ching of this system of orthopedic technics. This has been rtly due to the lack of trained and skilled demonstrators and the sistent teaching of roundabout and cumbersome methods to oid difficulties, which, let us hope, will soon fade away under a re practical and systematized régime.

The steel for taps and wrenches is partially prepared by the nufacturer at a cost of about forty cents a dozen. The taps are de from engine-bur steel, cut into pieces two inches long, and ie-turned at one end to perfectly parallel shanks five-eighths of inch long, the exact sizes required for the several taps. At the er end a short shank one-sixteenth of an inch long, with abrupt oulder, is turned the same size, to be ultimately threaded for fin-ing the nut. The student threads the tap one-half the length of shank and files the end to a three-cornered taper, the facets of ich extend one-half the length of the threaded portion. Then s ready for tempering, which I need not here describe.

These instruments in use are held in a pin-vise.

This year we have commenced using with much satisfaction velers' twist drills, that are carefully selected as regards size, at a t of about forty cents a dozen. In use they are held in a lathe ick.

The wrenches are made of 5-32 octagon steel, cut six inches long, and dressed. These are made by the students into double-end wrenches of a standard pattern, which I have found to be most useful. One-eighth of an inch at each end is forged to an angle of forty-five degrees, and further flattened and tapered with a file to form the grasps. The slots are then cut with a flat parallel file to accurately fit two of the three sizes of nuts. They are aided in the fitting process by short pieces of square wire that have been drawn through a square-hole draw-plate to the proper sizes.

Up to the present time we have made the nuts from nickel five-cent pieces, in the manner described in former papers.

I now take pleasure in introducing a method which will greatly facilitate this work. It consists in partly stamping the nuts with steel dies. (See Fig. 3.) The dies can be made to stamp four nuts. A greater number has been found to be not advisable on account of the great force required in the stamping process. By examining the die with the nuts in progressive stages of construction, which I here present, it will be seen that the centers are deeply punched for drilling and tapping, and the walls accurately cut the proper sizes required, about one-half the thickness of the nut. The final sawing and finishing to these prepared surfaces will not be difficult. Among the important advantages of this method the nuts will be uniform in the sizes required, and with walls that are uniform in their distance from the threaded hole.

The work has been greatly simplified and systematized by insisting that the grasps of wrenches and the external sizes of nuts shall be accurately cut to three standard sizes, large, medium, and small. The large for Nos. 13 and 14, contouring bars; medium for Nos. 16 and 18, jacks and traction bars, and small for Nos. 19, 20, and 22, traction and alignment wires.

Nuts should contain no more body in the thickness of their walls than is necessary for strength. They should be slightly tapering, as an aid to grasping, and the free ends and corners rounded to prevent irritating projections.

The proper construction of banding material is one of the most important factors in regulating. It should possess the highest degree of pliability that is possible for German silver, in order that it may be drawn tightly round the teeth in measuring for the joint, and finally for the perfect adaptation of the band after it is soldered.

is can only be accomplished by thorough and repeated anneal-s during the process of rolling, and then after it has been ught to the required thickness it should be coiled into rolls and d at a red heat for one hour. The latter requirement may be omplished by placing a large number of the rolls over a jacketed -burner, with intervening layers of plate or sieve wire to protect m from the direct action of the flame. Or they may be placed in muffle of an automatic gas furnace.

Banding material is made of German silver wires, Nos. 9 and 13, ich are both rolled to Nos. 34, 36, 38, 39, and 40, giving us two lths of each number. The requirement for each student is two lths, each two and a half feet long, of the size assigned to the tion. The two sizes of wires are cut the required lengths for r students who work in teams to one gauge number. One and a f feet of No. 9 wire will roll to twelve feet No. 34 banding terial, and one foot will roll to twelve feet No. 40. Two feet . 13 wire will roll to twelve feet No. 34, and one and one-quarter t to twelve feet No. 40.

These results are not unvarying, but will, I think, give a gener- three feet of banding material of both widths to each student h which to fill their technic stock requirement, and allow for technic regulating apparatus.

The waxed separating tape is prepared from German flax tape, ich costs about twenty-five cents per gross. We obtain it in ee widths, three-thirty-seconds, five-thirty-seconds, and one-rter inch, the latter to be used double for wide separations. The ins are rolled to hard coils, using a match for a starter and rling handle; then they are dipped into boiling white wax.

DISCUSSION.

Dr. S. H. Guilford. I have nothing but commendation for the k and the paper of Dr. Case. I see the advantage here of hav- some one who gives his exclusive time to work of this kind in dental college. In our Eastern colleges I believe this has not n the case. The matter has rested upon the one who taught rative dentistry, and I feel sufficient time has not been given to On the other hand, there is the danger of carrying the matter far. Dr. Case anticipated that objection in the early part of paper, that the question might arise as to whether we were

giving too much attention to it. I don't think we can give too much attention to principles, but I think, with our present courses, we are apt to give too much attention to detail. While his work and drawings are very admirable, it seems to me some of them can be dispensed with. If I were to undertake to do that in my college the students would have to give four months to it, or two half-days each week for four months. The question is whether we could do it and give them time enough for the other work. As to making taps and dies, the students in the different colleges of Philadelphia have simplified that very much. That is to say, we can buy from the manufacturer square wire made of German silver, any size wanted, correctly made, in full lengths, or cut up into suitable sizes for nuts. Some years ago I went to a manufacturer in this city, and he made me partially prepared nuts. From a solid piece of wire the nuts are made of different lengths, and we save the necessity in that way of stamping out of solid nickel what we can get ready-made.

In regard to the die and die plate, Dr. Case has done very commendable work, and of which I have heard for the first time to-day, of having plates made of uniform sizes. I have realized the difficulty of drawing down wire to a correct size. There are not enough holes in the draw-plate, and they are not correctly gauged. We have obviated that difficulty, as Dr. Case has also, by taking No. 8 or No. 9 German silver wire, having it annealed, and then drawn through a draw-plate. Mine came from Cleveland, and we find it a very excellent thing. We have it in the college ready for use at any time. Before we draw we see that the wire shall be the same size as one of the standard holes of the draw-plate, but when the new draw-plate is out it will be a great improvement upon that.

The point I want to make is this, that with regard to making the nuts we have simplified that by having them partly made for us. Dr. Case uses three sizes of screws; Dr. Angle has two sizes. I have found in my work that one size is generally the proper size. It answers my purpose; so that we confine ourselves to one. To the same man who furnishes the wire I took a pattern I had, and he made this die, which he sells at about a dollar and a quarter. There is but one size, but it is the most perfect in the world. It is made like a machinist's die they use for cutting threads. I presume the most of you are familiar with it, but if I had anticipated this com-

ing up this morning I would have brought some of them with me. By taking away some of the roughest work, I believe in their drawing down the wire; they have to do that. But when it comes to stamping out nuts and work of that kind, I believe the time can be more profitably spent in other ways. So I feel that much of the work should be done by some one outside, and that the finer work should be left for the students to do. By combining the two you save the students time and get the same result. In my experience I cannot recall a case where I have needed more than one size of screw and nut, different sizes and different lengths, but one gauge.

The plan and details of Dr. Case for orthodontia technic is very admirable. It is much fuller than anything else we have ever had on the subject, and I am obliged to him, for it will help me and others. I don't propose to copy it in its entirety, but I propose to get some valuable ideas from it. One of the things that appeals to me is the idea of getting up a draw-plate gauge-plate that will enable us to do our work better than we have done.

Dr. T. E. Weeks. While I do not teach orthodontia, I am somewhat familiar with the plan that is practiced by Dr. Weisse, and I feel rather familiar with Dr. Case's ideas, for the reason that through our intimate friendship I have probably obtained more of his ideas than I otherwise would have done; but I want to say a word in regard to the presentation of this technic. I think we cannot thank Dr. Case too much, for it is very complete. His idea was to give a full presentation of the whole subject of orthodontia technic, and it is in harmony with the ideas of the men who have presented syllabi and outlines of their branches of technic, that they would be complete, and thus enable teachers to select such as could be applied to advantage in their own work. And I think we ought to make an effort to keep this in mind all the time. In our association I have noticed a tendency to interpret what was rendered as being urged for all. I am not certain that Dr. Case's idea was in entire harmony with the other lines that have been presented, but it was a very full presentation for the express purpose of giving every one an opportunity to select. It seems to me that what we should endeavor to get out of these presentations is to select a course that will include the best, and let that course be adapted to our own individual needs.

Dr. G. H. Wilson. It seems to me we are apt to look at this

work as something more than the rest of us are able to accomplish. We know Dr. Case has accomplished it, but why? Simply because the work has been systematized; and that is the real aim of our association. This work is put into the hands of a man whose business it is to teach this. He is given a certain amount of time, and he should develop it to the very highest point possible. That is what Dr. Case has done. You can see what is possible when it is systematized. The amount of time given this work is no more than the subject demands, but, at the same time, it is making the best use of the time. So I believe that the lesson for us to learn to-day is to systematize our work, and then more can be accomplished in the time at our disposal.

As to having material prepared for us, to a certain extent I don't believe it is the best thing. I believe the more manipulative work we can compel our students to do, the better it is. We want to learn to use our hands. We had a fine demonstration of that last night. If we as dentists could use our hands as we saw the young men do it I believe it would be a great benefit, and that is only accomplished by repetition. So the more we compel our students to do, the less time they will have to spend in the smoking-room.

Dr. J. G. Templeton. I have heard lectures given by Dr. Case quite a number of times, but never before saw him illustrate anything in regard to the technics of orthodontia. There was one thing he mentioned that I was very much pleased to hear, and that is in reference to obtaining a knowledge of physics as a preliminary qualification to this work. The knowledge of physics, so far as the law of force is concerned, is a very great advantage in all prosthetic work; particularly so with regard to this work. By having this knowledge of physics a person understands where to apply the force, and where the force will come by using these appliances.

Dr. N. S. Hoff. It seems to me that the presentation we have had this morning will make us realize more and more the necessity for this organization. Although I have known considerably about the work which Dr. Case has been doing, I have not had a proper conception of the method he has employed in instructing his students; and the thoroughness with which he has gone into the details gives me some idea of the value and necessity for a complete presentation of this work in orthodontia technic. We have never before had anything like an adequate presentation of this matter to

us, and it only serves as a beginning. Dr. Case in this presentation has given us only one method. There are other methods, and these will in due time be presented to us, and by and by we shall crystallize these different ideas into a complete system. It is again evident that our work is not done. We here have only the beginning in this particular department. Many have thought there was not enough to keep up interest in this association in years to come. Here we are starting out on a new subject which has been clearly presented, and only one phase of it has been shown. Dr. Case has not even suggested the technic of the application of the appliances that he has shown us for the accomplishment of the purpose for which it is intended. There is a technic in the application of appliances which we must have to give to our students; how this material is to be utilized in correcting irregularities. Some day we will get down to fundamental principles in that respect. There is an opportunity for enlarging this work, it seems to me, of which we can hardly see the end. It would occupy our whole time for perhaps a week to discuss this one part of our work. I feel that we are greatly indebted to Dr. Case for so ably presenting to us such a complete system as he has here presented for this part of our work. I hope next year we may have a further presentation, including also other methods.

I am very much interested in this particular line of work. In our school we teach it, but not to the extent shown here, which I hope we may do and make our teaching in this subject more systematic than it has been. We teach other methods; none of them are complete or satisfactory. When we get a presentation from other specialists who are doing the same work by other methods and means, as fully as this has been, by bringing them together we shall have a complete system of the means used for this purpose. I don't think we could have a better basis for our work than the one that has been presented here this morning. I want not only to compliment Dr. Case for the manner of the presentation, but to thank him cordially for the thoroughness with which he has done it. He has gone to great pains to present the matter with all this detail, and I am sure we owe him our best thanks for it.

Dr. W. H. Whitslar. The argument presented by Dr. Guilford as to having students buy material is one I think not quite correct, for the reason that about fifty per cent. of the students will

go into the country to practice, or in country towns where this material cannot be purchased, and it is necessary for them to be competent or able to prepare their own material to work with. Often they do not have the means to communicate with merchants in large cities, and don't know where to buy these materials. For that reason I think it is advisable for them to prepare these different instruments, wires, nuts, and so on, for themselves.

Dr. H. J. GOSLEE. I am quite familiar with Dr. Case's system of technic work, having had the honor of being his associate for three or four years, and I cannot resist the temptation of adding a few words of approval of the outline he has presented to us here to-day. When I think back only three or four years, and see the results we got from our students at that time and compare them with those we get to-day, it is almost astonishing to see the improvement. That improvement has been gradually made by time, thought, and study. It has been worked out carefully by Dr. Case, with results that are better by far than they were then; and this result is due largely to the fact that the students have been required to make these appliances themselves. At the time I speak of, three or four years ago, we permitted them to buy the tubing ready-made; buy the wire, the taps, supposed to be of the proper size, buy anything they could that would answer the purpose. Those students when they got through didn't know anything about regulating or the construction of regulating appliances as compared to the boys of to-day. We all appreciate, I am sure, the manual training that the construction and preparation of these various materials must give the students. We all appreciate the value that it is to them. Dr. Guilford said he did not think we had time enough to present this subject as thoroughly as Dr. Case has outlined it. I would like to say that it does not consume a great deal of time. I dare say we do not devote much more time to this work in our school than Dr. Guilford does in his, but it is so thoroughly systematized more can be accomplished. Two afternoons a week for four months is not a great deal of time, and I am pretty sure the average curriculum of the average college could find plenty of opportunity to give to orthodontia technic that much time.

About dies for nuts, Dr. Case has brought them to a system of perfection and simplicity, and that has been a stumbling block in working out the system he presents; but we have found a steel die

that will cut four nuts at once a success. Four or five minutes will finish a nut, stamp, cut it out, and thread it. When you have a systematic method the time consumed is not nearly so great as might appear from the time occupied in presenting the subject.

Dr. S. H. Guilford. I think Dr. Whitslar and some others have misunderstood what I said. I am an advocate of students preparing their own material. The only point I made is in the kind of material. I mean the matter of making nuts, which is one of the most difficult things they have to do. If they have a die it can be done, but if each student has a die it will add to the expense of the equipment. The wire costs almost nothing, and it don't help the student much to make that wire.

Dr. H. P. Carlton. Dr. C. L. Goddard handed me a syllabus which he uses with the students of our school. Dr. Goddard gives his whole time to teaching these subjects. We have a complete course of this character. The syllabus follows:

As I cannot be present to take part in the discussion of the paper on orthodontia technic, I will offer the following description of how the subject is taught in the Dental Department of the University of California.

One lecture a week is given to the senior and junior students assembled together, and, in addition to this, the juniors are instructed in "technic" by my assistant, while the seniors treat practical cases throughout the year under my personal supervision.

By many it may be thought that lectures on this subject should be given to seniors only, but I find that they are better prepared for the practical cases of the senior year if they have listened to lectures during the junior year, and that they need a repetition of them to fix methods and appliances in their minds. The lectures are illustrated by drawings, lantern slides, and blackboard work.

The drawings of the teeth are made in black and white, but the appliances are drawn in different colors, as follows: Yellow representing gold or German silver; gray, platinum; blue, steel; dark red, vulcanite; green, soft rubber; pink, silk or linen ligatures, etc.

I think the subject is best illustrated by blackboard drawings, because the irregularity of the teeth can be first outlined in white, then the appliances added in colored chalk; and the construction thus clearly explained in its various stages.

For convenience of description and illustration, irregularities are

divided into fifteen classes. The etiology of each class is explained with more or less minuteness, and authorities quoted.

Oral quizzes are held occasionally to review causes, plans, and theories. Quizzes on treatment are held as follows: The blackboard is covered before the lecture with drawings in colors, representing classified irregularities and various appliances for their treatment. These drawings are numbered, and students are called up in turn to point out and explain the irregularity and treatment. Students seem very much interested in these quizzes.

On one of the walls of the lecture room is a small cabinet, in which are placed, before each lecture, casts illustrating that lecture. These casts are left in this cabinet till the next lecture, for inspection.

The orthodontia technic work is conducted by my assistant, but under my directions, as follows: Each junior student is provided with a piece of No. 13 B. & S. gauge German silver wire and a piece of 23 plate. From these he is required to make all the prescribed appliances that can be constructed of that metal. Other metals or materials are provided when necessary.

He is required to roll out plate, draw wire, make tubing, both round and square, cut threads on wire, make a drill and tap, nuts, and a series of "partly-made" appliances. These are all placed on a card prepared for the purpose, and constitute the first set of appliances that can be used afterward in constructing a few typical ones that are fitted to and presented on plaster casts. Original models of a few typical cases are prepared by my assistant, from which students take impressions and make their own casts. The models and appliances required are varied somewhat each year.

In the senior year each student is required to treat at least one practical case of irregularity or deformity. Whenever possible, a cleft-palate case is assigned.

The superintendent of the infirmary assigns a patient to each student, who first fills out a blank descriptive of the case, takes impressions, and makes articulated casts of the upper and lower teeth. At a weekly clinic the patient is presented for my inspection and advice. After examination a drawing is made on a blackboard near the chair showing the irregularity in white; then the appliance prescribed is added in colored chalk, and described to the surrounding class. If the case presents any unusual features, a

clinical lecture is given then and there. These short talks are very valuable in supplementing the regular didactic course, and the students' attention is called to many phases of eruption and changes in position of the teeth that cannot be shown except in the mouth or on the face of the patient.

The student in charge of the case in hand is instructed to make the prescribed appliance, place it on the patient's teeth, and present it at the next clinic. As soon as one case is thus disposed of, another is taken up in the same manner. The same patients are presented at subsequent clinics for inspection and advice until the correction is completed.

In a wall cabinet with a glass door, just behind the chair, all the original articulated casts are kept, so as to be readily compared with the patient at the clinics and progress noted. A record is kept of each inspection of the patient.

I want to say just a word about where the clinics are held. I use a chair that fronts a window and is beneath a skylight. There is room for quite a number of students to stand so as to see the case well without obstructing the light. Behind the chair is a washstand with running water, provided with soap, nail-brush, and clean towels. On one side of the stand is a blackboard with eraser and colored chalk. On the other is the cabinet with a glass door. Spaces are reserved for the casts made by each student, and the student's name placed in front of the shelf, so that any case can be found in a moment. In this cabinet are kept a few instruments and supplies that may be needed in the clinic.

When a case is completed and a retaining appliance in place, if necessary, the student presents articulated casts showing the teeth in their new position. He also makes a duplicate of the original model, and places on it the appliance used or a duplicate. These three casts are then fastened to a small board, and show successively the case as begun, in progress, and completed. In some cases additional casts are made to show different stages of treatment or changes in appliances.

In the exhibit presented for your inspection specimens of our junior students' technic and senior students' practical work are shown, as also copies of directions that are furnished each student before work is begun.

I regret that I cannot be present at this meeting to see the rest of

the exhibit and hear the papers and discussions. I have much yet to learn, and feel that that is the place to learn it.

Dr. W. E. GRANT. I was glad to hear the paper and what Dr. Wilson has said as to the importance of one devoting his time to this work, and to the number of hours allotted to it. That is the keynote to all technic work, the amount we try to accomplish in the schools. When we come to consider the number of hours, Dr. Case, as I understand, gives ninety-six hours a session to this work, six hours a week for four months. Those of us who feel we could not give that much time could give seventy-two hours, or even fifty-four. In my school we now give fifty-four hours a session to orthodontia technic work. I find it is not only beneficial in giving manual training, but by varying it, that is, by assigning students to some piece or to phases of the work that represent the views of different authorities upon this subject, that they become familiar with the different men's ideas. For instance, I have them make some of the work that represents Case's idea; again, work that represents Angle, Jackson, Guilford, and others who have suggested some special appliances. It gives them a technique and an idea of the application of the different classes, and they get it in a better manner than I could possibly present it in demonstration or by didactic lectures.

Dr. C. S. CASE, in closing, said: I don't think there is anything more I need to say, except to thank you for the words of commendation that you have expressed for the work we do along this line.

In answer to the question relative to seamless tubing, I have had no experience with that, as we do not need it at all. The seams of all tubing are soldered next to the band, and the solder closes the seam. In other places, where the tubing is free, it is not necessary to have the seams closed. They never open if they are closed properly.

In regard to the construction of nuts, it has been for some time a stumbling block, although the method of making them of some solid material is far superior to anything else. You get the advantage of all the solid material in the strength of the threads of the nut. In fact, we have tried every method that has been used. The method that Dr. Guilford has spoken of has been tried by us. We have found that it does not favorably compare with the method of making them out of the solid material.

PRINCIPLES AND TECHNIQUE OF ROOT-PREPARATION.

By H. J. GOSLEE, D.D.S., Chicago, Ill.

There is probably no distinctive feature in the teaching of the subject of crown- and bridge-work that is of more intrinsic importance, that is more negligently treated, and that is more replete with attending difficulties than a consideration of the proper and skillful preparation of the roots of teeth for the purpose of restoring their natural condition by means of accurately-fitting artificial substitutes in the nature of crowns. I can, indeed, conceive of no other more important phase of the entire subject that is treated in such a perfunctory manner by the profession in general, and yet to this seeming indifference or negligence, wherever it may be apparent or manifest, can be attributed much of the trouble and many of the failures which must ensue.

The common cause of such failures and countless discomfitures in the shape of gingival inflammations and peridental and alveolar absorption can be almost invariably traced to the irritating influences of an imperfectly adapted band, due primarily to faulty root-preparation. And yet, since the profession has in the main agreed that the crown with a band, because of the additional protection and stability afforded, is the ideal crown, it necessarily falls upon us as teachers to take the initiative in endeavoring to correct the mistaken ideas, cultivate the field of errors, and place the proper significance and importance upon the requirements.

As the architect and builder intelligently and systematically prepares the foundation for that which is to stand as a monument of his skill, with the same care, precision, and accuracy must the foundation for work of this nature be prepared. Success in any line of mechanical procedure means method, system, a clear, concise comprehension of principles involved, and strict attention and adher-

ence to the most minute of details. Particularly is this so where art and mechanics are merged together, and where the field of labor is confined to vital sensitive tissues.

While the requirements of a crown are fit, occlusion, and approximal contact, the first is the primary and essential element to ultimate success, permanence, and comfort, and is entirely dependent upon not only a conception of the underlying principles and a thorough execution of the details and manipulative procedure, but a knowledge and appreciation of the significance of their importance.

It is my purpose to so emphasize as to impress this upon us; to advocate that the importance demands a systematic and practically scientific arrangement of the subject, and, incidentally, to present to you a concise outline of the teaching methods I use and suggest in this respect.

That the subject may be best, and perhaps most easily and intelligently considered, I have decided it advisable to divide it into two general classes: Root-preparation—First, requirements; second, classification.

Requirements.

This portion of the subject includes the necessary preliminary or primary procedure, and, consisting of three steps, is in turn subdivided as follows: Requirements—First, treatment, filling, and preparation of canals; second, restoration of continuity of walls; third, destruction or diminution of crown.

Treatment, Filling, and Preparation of Canals.—This consideration is given precedence for the important reason that it should invariably precede the sacrificing or removal of any of the remaining portions of the natural crown, because of the advantage thus rendered in the application of the rubber dam and the necessity for it, without which the facilities for the success of the operation may be materially impaired. The preparation of the canals will be subsequently considered.

Restoration of Continuity of Walls.—This second consideration becomes necessary only in those cases where decay is more or less extensive toward the cervical portions, and which, when accomplished, prevents the possibility of fracturing the remaining unsupported walls in the preparation of them, greatly facilitates the fitting of the band, and overcomes the probability of future decay

because of imperfect adaptation of the edge of the band to the margins of deep cervical pockets. This procedure is of great importance in many cases, and can perhaps usually be best done with amalgam with the most permanent results.

The Destruction or Diminution of Crown.—This procedure especially refers to a consideration of the requirements which necessitate so shaping the remaining portions of the crown or root as to render possible the fitting and adaptation of a band to the constricted portion of the neck beneath the gingival border of the gum.

Classification.

In considering this phase of the subject we are, of course, governed by the particular style of crown indicated; and while crown-work is divided into two general classes, the shell or telescope and the post or dowel, the individual indications for a crown and the variation in the essential features of root-preparation require that it be considered in three general classes: Classification—First, preparation of root for shell or telescope crown; second, preparation of root for post or dowel crown with band; third, preparation of root for post or dowel crown without band.

For the purpose of illustrating the distinctive features and the requirements in these separate classes, I have had made a set of original models designed from actual measurements of typical tooth form, magnified twenty times in each diameter.

Preparation of Root for Shell or Telescope Crown.—Under this first class we of course meet with the most difficult operation, because of being confined to the posterior teeth; and most usually the molars, where it is necessary to secure a diminution of the crown dimensions at all points equal to the diameter at the cervix, and to sacrifice enough of the occlusal surface to allow for a reproduction of the cusps; while it is of course desirable to leave as much as possible of the remaining tooth-structure.

To secure this result it will be observed that at least the occlusal one-fourth of the crown must be sacrificed, and that one-sixteenth of the tooth-structures from each of the four walls must be removed in order that all occlusal dimensions may be reduced equal at least to the dimensions at the cervix where the band is to be fitted. The remaining *"stub"* will give a very lucid idea of the required diminution of the crown, and the thick edge of the sectional rim will clearly

demonstrate the amount of tooth-structure sacrificed to secure this absolutely necessary preparation.

The absolute necessity for the removal of tooth-structure when an artificial substitute for the crown is indicated is at once apparent, while it is readily granted that the same entails considerable effort, and may require the destruction of the vitality of the tooth.

The question of the feasibility of devitalization in the great majority of cases enters largely into and is probably the most important phase of the subject in this connection. However, I manifest no hesitancy in saying that in a large proportion of cases between the ages of eighteen and forty-five or fifty it is impossible to secure a proper preparation of these teeth without so doing, unless the patient be made a martyr and subjected to the tortures of the Inquisition, irrespective of the oft-repeated theories of ultimate death from isolation, from the irritating influence of oxyphosphates or oxychlorids of zinc to the denuded surfaces of dentin, from the presence of metallic arsenic in the oxids of zinc, or from the effects of the inflammatory stages probably present and due to the influence of caries before crowning.

Any of these, or a combination of them, might well be expected to cause subsequent troublesome manifestations at some period, remote or otherwise, but the primary fact remains that so much tooth-structure must be sacrificed, that the walls of the remaining root must be parallel in order that a crown may be perfectly fitted.

Can this be accomplished when vitality is preserved? Would the patient tolerate the intense, excruciating pain necessarily produced by a perfect operation in the average case? Would the pulp survive the shock? The exceptions would be in abnormally formed teeth, in cases of faulty enamel formation, sometimes where there may be no adjacent or occluding teeth, and in those conditions regulated by age; but the exceptions do not affect the rule, and the principles are an important part in the consideration of the technique of the subject in general.

Preparation of Roots for Post or Dowel Crown, with Band.—The second class of root-preparation is of no less importance than the first, the indications being principally confined to the ten anterior teeth, and necessarily involve the destruction of the pulp and much tooth-structure, since the artificial crown replaces the entire natural one with the seam of union at the gum line.

After the treatment and filling of the canal, the technique of the procedure is as follows: The continuity of the remaining crown proportions should be destroyed, so as to leave the buccal or labial and lingual walls standing alone and somewhat unsupported by dentin. In the destruction of these walls it is necessary, then, to observe the precaution of preventing a rootwise fracture by cutting through the enamel with a thin knife-edged stone at a line which, it will be noted, approximates the cervical one-fourth of the crown, when each wall can then be quite easily broken down to this point with pliers or excising forceps, which leaves the remaining root probably a sixteenth of an inch longer than the gingival border of the gum.

This distinctive feature in the preparation of roots for this now perhaps most common style of crown is essentially necessary and should be invariably observed, because of three decided advantages: First, this exposed portion of the neck of the root greatly facilitates the peripheral preparation, in that the remaining ledge of enamel can be removed with ease and dexterity; second, it renders the securing of an accurate measurement a simple and easy procedure; and, third, the end of the root here remains to shape and guide the band in fitting it to conform accurately to the walls.

When the band has been thus fitted, removed, and cut down to the proper depth, this remaining portion of the root is then sacrificed with flat-edged stone or root-facer to the proper line.

It will be noted here that the face of the root when the preparation is complete is but slightly beveled, so that the labial or buccal surface is a trifle shorter than the gingival border of gum, while the lingual is a trifle longer, with the angle formed by the beveling a little to the lingual of the center of root, the reason for each being obvious, because the buccal or labial must be shorter than the gum in order that the facing may be placed in contact with it, and the cap practically invisible; the lingual should be longer to overcome in a measure the force of leverage in the opposite direction, which is especially indicated in the six upper anterior teeth, and the angle slightly to the lingual of the center to allow surface for the approximation of the neck of facing to the cap.

Preparation of Roots for Post or Dowel Crown without Band.—In considering this, the third class of root-preparation, it may be advisable to mention that while such a crown is quite often indi-

cated, yet, regardless of the adaptation, it does not insure the permanent results afforded where the root is banded, the success of such crowns depending entirely upon the adaptation of crown to root.

The procedure up to the removal of the remaining portions of the natural crown is similar to or identical with that indicated in the second class, but differs from this point in the fact that *peripheral preparation* is unnecessary; and that in cutting the root on down after the removal of the crown a lingual bevel is necessary in order, by thus *saddling* the end of the root, to overcome the force of leverage in an outward or lateral direction, such as is sustained by the artificial crown in the act of mastication.

The labial or buccal edge should be carried slightly below the gum line for the reason indicated in the preceding class, while the lingual should be longer than the gum, so that the adaptation of the base of the crown may be closely observed and the seam of union or joint between the two rendered self-cleansing by being exposed to the movements of the tongue and action of the saliva; while the angle produced by this bilateral bevel should also be a trifle to the lingual of the center of the root, to leave surface room for the facing.

In those cases of extensive decay resulting in the presentation of a concaved surface to the end of the root, where perhaps a crown without a band is either the only alternative or most frequently indicated, it may not be possible to secure this desired form; in which instance it becomes necessary to secure a perfect adaptation of the base of the crown to the entire surface of the end of the root in order to secure the best and most permanent results, and which can be easily accomplished by means of impressions, dies, swaging, and burnishing.

Canal Preparation.—Since the post or dowel in the crowns designated in classes 2 and 3 plays such an important part in the retention and stability of the crown, it is necessary that some attention be given to the preparation of the pulp-canals for their reception. This consists in enlarging them sufficiently to receive a post proportionate in size with the diameter of the root and the requirements of the crown, which should fit at least two walls, extend into the root a depth equal to the length of the crown from the end of the root to the incisal or occlusal edge, and project through the cap far enough to the lingual not to interfere with the facing.

While there may be some slight variations in the consideration of this subject, they will probably be mostly of an individual nature, and yet come under the same general principles herewith outlined. And I have purposely avoided all reference to instrumentation as far as possible, because of the ingenious individuality usually displayed in the manipulative methods of accomplishing such procedure and of its being in itself exhaustive enough to receive separate consideration, attempting only to impress upon us as teachers the value and importance of the principles of root-preparation as being synonymous with success in this line of work.

The address was illustrated with large artificial teeth, constructed of wood and in sections, so as to show the different parts of the teeth and the manner of operating upon them.

DISCUSSION.

Dr. H. W. Morgan. The models Dr. Goslee has presented appear to me to be most excellent. If I were a teacher in that line I should certainly enjoy very much having such to exhibit to my pupils. They show very clearly, and much better than words or diagrams, or anything else, the ideas they are meant to convey. Dr. Goslee's paper is the first presentation of this subject in a systematic way that I believe our association has had, and I wish to compliment him upon his divisions of the subject.

I would take issue with him in the restoration of his continuity. I think there are other materials which will answer as well or better than amalgam, but, as materials are not under discussion and we are speaking of technic, I shall confine myself rather to that feature of the discussion than to entering into methods and modes of practice as to material.

I was glad to hear him condemn dowel crowns without bands. Underlying the whole of the subject, it seems to me there should be a knowledge of the anatomy of the teeth. There is one point I would criticise, and that is the conflict of terms, as it seemed to me. The doctor used the term "gum line" frequently when he meant the gingival border; sometimes used the "gum" line when he meant the gingival line itself; and if he could have made any improvement in the paper it would have been along these lines in reference to terms. There was some confusion. We know when we come to

trim down the root of the tooth, if we cut clear down to the gingival line, especially in the young, we encroach upon the peridental membrane. There is not much danger of gingivitis unless we have carried our band beyond the free margin of the gum and begin to impinge upon the peridental membrane or alveolar process. Therefore a knowledge of the curvature of the process in the interdental space should be first thoroughly understood. The gingival line itself, the curvature of the line, must be thoroughly comprehended before we can intelligently fit any band to a tooth. We must know the curvature of the anterior teeth and those of the bicuspids, and still more important it is to remember the curvature of the gingival line around the smaller teeth. A little more will be developed possibly in the doctor's next paper along that line.

I was somewhat surprised at the end of the paper, in looking it over, that he confined, or rather had defined, the title of his paper as a preparation of roots. It involves still more than that, rather the preparation of the stump. It is the preparation not only of the roots of the teeth, but of the stump that is left of the tooth. I would take issue there in that respect. In the preparation of the roots of the teeth I am very sorry, from the clinical standpoint again, that he did not go a little more into the minutiæ. I don't find it in my practice such an easy thing to remove that portion of the tooth which he very nicely showed us that remains after the tooth has been cut down to about that shape (indicating on board) and getting rid of this material, especially the enamel, that is left. Enamel cleavers and instruments of that kind do not always work so easily in my hands. It is a difficult matter, and especially to students just beginning this work, and especially so in an infirmary. I wish in his next paper he would just enlarge along that line somewhat. It would be of very great assistance to us.

Dr. H. P. Carlton. This appeals to me particularly as being a methodical and systematic presentation of the subject from the teacher to the student. The models are beautiful. I have never seen their equal anywhere. If I were a teacher of prosthetic dentistry I would at once want to possess a set of them. I can indorse, with one exception, all he said, and perhaps I may change my opinion in that direction. Up to this time I have not destroyed all of the pulps of the molar or bicuspid teeth in their preparation for the reception of shell crowns. I destroy more now than I used to.

The time may come when I shall destroy them all as Dr. Goslee says, yet I do not now destroy them in such a radical manner as he says he does.

Dr. I. N. Broomell. I wish to refer to one or two points. One of these is the necessity or relationship which should exist between the metal cap and the tooth-root, the tissue of the tooth. I believe it is customary in attempting to band the end of a root to make that band fit snugly and tightly to the tooth-tissue. I believe it is also customary to have the floor to the band set tightly against the end of the root. If we devote our efforts to have such a condition as that, we don't have sufficient room for the cement to serve its purposes. Therefore, I think in the preparation of a root sufficient space should be allowed for a definite amount of cement. This, of course, does not refer to the free extremity of the band, because there we must have perfect adaptation to conceal the cement within. In my teaching I always bevel the extreme end of the root so that I do not have a perfect adaptation of the band except at the extremity.

Of course we recognize that in the preparation of the roots of the teeth the amount of preparation depends very much on the condition of the root or crown, as well as the kind of crown to be applied. Dr. Morgan appears to take exception to some points in the essay by calling attention to the gingival border of the gum. I cannot conceive of such an expression to define the free margin of the gum, because in the gums we have the gingivæ; they are the gingivæ themselves, and speaking of the gingival margin of the gum we are repeating the word, beginning with that word and ending with it. It appears to me that the gingival margin refers to the edge of the gum, because the words are synonymous, gingiva meaning the gum. The term cervical line would be much better to use, because that gives us a definite point. The free margin of the gum or gingival borders are not always given a positive location. It may be more or less inflamed, and in that condition we have them somewhat extended beyond their normal location. In other instances they may have receded from some systemic or local cause, and then we do not have the positive line. The cervical line, which is a permanent line, that which defines the separation between the enamel and cementum, is the line to go by, rather than the gingival line, because the other is quite variable in its location.

The last gentleman spoke in relation to the destruction of the pulp. It appears to me it will only be a question of time when he will have to devitalize the pulps of the teeth which are capped with gold. I recall a case quite recently in which two bicuspids and a molar were all capped with gold, the teeth being vital when the caps were placed in position, with the consequence that the patient suffered the loss of the alveolus. She suffered great pain and disfigurement, and eventually suffered a fistulous opening through the cheek. I would most heartily always recommend the destruction of the pulp before capping a tooth with a metal crown.

Dr. C. J. Essig. I admire the models very much. They are beautifully made, and the scheme of the model is ideal. I think, as Dr. Morgan said, that a little detailed description of the instruments used and the method of reducing the margin for the reception of the ferrule would have been interesting. As Dr. Morgan states, it is one of the most difficult things we have to do in our office work to properly reduce these edges so as to receive the ferrule.

Dr. Goslee, in closing, said: Dr. Morgan referred to the restoration of the continuity of a root with amalgam. I believe my experience bears me out in making this assertion: Where the paper referred to the use of amalgam was in those cases where we have deep cervical pockets which it will not be possible to cover with a band, in which instances we must necessarily use something permanent; and there is nothing else I know of that would offer the assurance of permanency. I have been called to task for that two or three times, but if you will note the paper particularly you will see it refers to deep cervical pockets, where in all likelihood it is impossible to perfectly adapt a band to the edge or margin of the tooth.

My terminology and nomenclature was, I realize, not absolutely correct. I appreciate the criticism made by Dr. Broomell and Dr. Morgan with regard to the gingival edge. I believe that would be the correct term for those particular references with regard to the gingival border, where I spoke of it as the gum line. While they were not absolutely correct, they illustrated what I meant, though I was not right technically perhaps in presenting them in that manner.

Dr. Broomell has said what I would say to Dr. Carlton. I believe every one will sooner or later come to that conclusion. If you have

any hopes of permanency in shell crown work it must be through the frequent destruction of the pulp.

With regard to the perfect relation of the band to the face of the root, if it fits the extremity perfectly we accomplish almost all we desire, and I feel sure the less cement we have the stronger must be our relation between the crown and root; because certainly if we have a cap fitting the face of the root perfectly there will always be room enough for a thin film of cement, and there will also be room in the pulp-canal for enough cement to carry that crown permanently.

SYLLABUS FOR DENTAL CURRICULUM.

By FANUEIL D. WEISSE, M.D., New York, N. Y.

I must preface the consideration by *me* of this subject with an apology for not being a dental surgeon. Thirty-five years' experience in helping to guide the evolution of the curriculum of the New York College of Dentistry is my excuse for venturing, in this presence, to express my views on the subject. In the fundamental medical departments we are on common ground, but in the dental departments I defer to the specialists in dental surgery.

I would here note that I have purposely avoided any allusion to the method by which the curriculum may be imparted to students. I have only epitomized the subjects that should be studied, giving the scope of each, to educate men for the scientific practice of dental surgery as a specialty of medicine.

The dental curriculum of to-day should include the study of the following subjects:

1. *Prosthetic Dentistry* in its respective fields of orthodontia and prosthesis.

2. *Operative Dentistry* in its respective spheres of extraction of and operations for the preservation of the teeth.

3. *Physics*—the physical and mechanical phenomena of matter and the forces which determine them, with a clear comprehension of the molecular physics of the materials used in, of the mechanical contrivances used in, of the mechanics of, and of the statics of the making of dental appliances and of dental operations.

4. *Chemistry*—the general laws of chemistry, the chemistry of the human body, and the chemistry of all substances, metallic and non-metallic, used in prosthetic and operative dentistry.

5. *Anatomy*—a general knowledge of the human body, and an exact knowledge of the descriptive and relative anatomy of the head.

6. *Dental Anatomy*—familiarity with the external forms, interior cavities, and cavity walls of the several teeth, temporary and permanent.

7. *Dental Comparative Anatomy*—a clear conception of the variations of the dental organs in the several classes of vertebrates.

8. *Normal Histology*—a general perception of all tissues of the body, and an exact perception of the developmental and mature histology of the tooth and its tissue environments.

9. *Physiology* of all the functions of the body, with particular consideration of the nutritive functions of digestion, assimilation, and disassimilation.

10. *Pathological histology* of diseased tissues in general, and a thorough appreciation of the morbid changes in the tooth and the tissues that surround it.

11. *Bacteriology*—the recognition of the bacteria found in the mouth, the laws of bacterial life, and the effect of bacteria in producing and carrying forward pathological conditions of the tooth and its root investments.

12. *Pathology*—the factors of tissue nutrition, the effects of aberrations of these factors, the results of irritation of tissue as presented in the phenomena of inflammation, and the reparative processes of tissues.

13. *Oral Surgery*—the abnormal conditions, of developmental, traumatic, or pathological origin, of the buccal parietes, with their surgical treatment.

14. *Hygiene* of the body in general, and of the buccal cavity and teeth in particular.

15. *Materia Medica*—of remedial substances used in dental practice.

16. *Therapeutics* in general, and the special therapeutics of all agents, prophylactic and remedial, used in the local or systemic treatment of morbid conditions of the tooth and of the structures covering its root.

17. *Anesthesia*—the agents used for and the methods used for the production of this state, both local and general, together with all restorative measures to be resorted to in cases of untoward symptoms resulting therefrom. In connection with the subject of anesthesia, it is imperative that the dental student should be made familiar, by didactic instruction and personal appreciation on others,

with the normal pulse, normal heart-sounds, and normal respiratory sounds, that he may be able to recognize the presence of variations from the normal, and in such instances decline to administer an anesthetic, local or general, without the concurrence of a physician.

I wish to make a special plea for the teaching of *physics*. But few of our dental institutions give the subject even a place in their respective three years' curriculum of educational work.

As a matter of fact, but few students enter a dental institution with a sufficient knowledge of physics to enable them to give the reason why a tool or instrument is made of iron, why a hammer has a wooden handle, or why a denture is held to the roof of the mouth.

Physics gives the reasons for the existence of every tool; as to the materials of which it is made, its construction, and how it fulfills its uses; and of every piece of apparatus, as to its material structure, its construction, and how it carries out the purposes for which it is intended.

Physics teaches the molecular forces that determine the properties of the materials used in prosthetic dentistry, and the laws which regulate the effects produced upon these materials in the application of forces to them. It is upon this knowledge that the prosthetic dental surgeon selects the materials and resorts to the procedures which enable him to carry out his work.

Physics guides in orthodontia; the selection of materials for appliances; the construction of the same, and the direction of force to effect given results.

Physics explains the reasons for the construction of the various operating instruments, the selection of the materials for the filling of teeth, and the results obtained by operative manipulations.

The so-called practical man may say to this plea for the study of physics, "I do not care for the how or the why! Give me the tools and apparatus, the materials and the practice, that I may obtain the results; these are all I care for!"

Such was the status of the dentist before the establishment of institutions for the education of men for the practice of dentistry as a profession. Dental educational institutions should see to it that such a status is not perpetuated at the present day.

To carry out the preparing of a "syllabus for dental curriculum" I would suggest that a committee of three be appointed to take

charge of it, with power to appoint an editor from their number, to select collaborators of the several subjects, and to accept or reject the work of the collaborators. The editor to have charge of the final compilation of the accepted work of the collaborators. I would also suggest that the subjects be not worked out into questions, but that each subject be divided into detail heads, which shall present an analysis of the knowledge to be acquired.

DISCUSSION.

Dr. S. H. Guilford. I think most of the ground covered by Dr. Weisse's paper is already in practical use. In other words, I think the different studies he has outlined are the studies of the usual dental course, and what he has included under each head is what is included in all the colleges I know of. But I was pleased to note he made a special point of one branch which, as he says, has been largely neglected, the subject of physics. He says there are but two institutions of which he knows that even so much as mention it in their announcements. As our institution happens to be one of those, I feel quite highly complimented. The subject of physics is an important one. It is true the elements of physics ought to be taught long before the student goes to the dental college. We are not expected to teach ordinary geography, reading, and writing. The student is supposed to know these things before he comes, and so I have no doubt it will be in a few years after the dental course has been extended that the teaching of physics, except in its higher branches, will not be necessary for a dental college. We can't teach everything, but if the student has been properly prepared we can give him something that will be of use to him. We can teach him how these principles are to be applied in our work and practice. The whole subject includes more probably than a student would care to undertake, as it includes light and optics, and we haven't much to do with that; but we do consider heat and electricity as most important. The subject of dynamics is all-important. We have to consider the application of power and force and resistance, as when we are making artificial teeth and mounting teeth they have to be set in such a way as to serve the purposes of the individual. Wildman, thirty-five years ago, was the first to speak of so arranging artificial teeth that the line of force should fall within the center of gravity, and not outside of

it. The line of force must be kept as nearly on the line of the center of gravity as possible. Then, again, as to the mounting of the teeth on blocks and single teeth, frequently the teeth break, and it keeps us busy explaining why that is. I remember an occurrence here in Philadelphia when the Public Buildings were being put up. The architect put heavy blocks of granite in position to support the weight that would rest on them. Everybody looked at them and smiled, and thought they would resist more strain than was to be put on them; but after they climbed up one, two hundred feet, and so on, it was found that portions of the granite blocks were chipping off, and then every one cried that the architect didn't know his business; that he had put stones there of insufficient strength to support the superstructure. The architect said if the people who criticised understood the principle upon which the stones were dressed, they would understand the whole problem. He said it was practically impossible to dress two stones so they would rest at all points, and, knowing that fact, men who dressed them dressed them so that the center should be a little higher than the sides and come together at the point best able to resist pressure. But in this case the stones were dressed in another state, and the instructions of the architect were not carried out, and the result was that the stones chipped. He said there will be no more of that. It is not the weight of the superstructure at all, but the fault of the dressing of the stone; and there has been no chipping since. In grinding blocks I teach the students, as Burchard sets out in his book, to make them so that they touch in the center, where they are the strongest and where they won't break.

That simply brings in the question of dynamics. Take, for instance, the filling of teeth where we are illustrating methods of putting gold in the cavity. We all tell them how to do it, but do we sufficiently impress on their minds why we do it in a certain way; why the gold in front of the plugger is at right angles to the plugger, so we can get the very best result possible? Do we tell them why we do it, so that every plunge or motion of the instrument is toward the center of the tooth, so as to have the effect of pushing the filling in the tooth instead of out? They know it might be pushed out when it is only half-completed, and we should explain why. So in building out the corner of a tooth, we teach them how to build down a corner in gold; and after that is done we

want to tell them in the preparation of the cavity how to make as secure an anchorage as possible, and then they should know how to prevent the corner from coming off. The way to prevent the corner from coming off is to prevent any great strain coming on a point that is farthest away from the resistance, and so we have the application of force coming in continually.

In the matter of crown- and bridge-work as you see it here, if you explain to students exactly where the strain on the root comes, and how they can best resist that strain, that is a very important feature; and in the matter of orthodontia we have to deal with it constantly. What kind of force to apply and how much, and the checking or holding that force in power. Did you notice last night how the lecturer spoke of using the chisel, pressing with one hand and holding back with the other? Simply showing how to have control of the force. And so in regulating, we want to apply that force in the right direction, and have the means of stopping or resisting slightly the power we apply. I do not know of a place where a knowledge of physics or an understanding of the basic principles of physics does not come into use, especially the sub-department of dynamics. While we cannot, with our present classes, expect them to understand so very much about it, except those who have had a very liberal education, I think the time is coming when they will know more about the laws of physics, and all we will have to do will be to call their attention to these laws and make them understand how they should be applied.

Dr. J. Taft. The subject or question of curriculum is one that has attracted a great deal of attention, but, after all, not very much has been done in the way of unification or bringing the profession up to the highest attainment in this direction in teaching. Effort has been made during the last three or four years by the National Association of Dental Faculties to bring into harmony the curriculum of the various colleges. The aim has been to ascertain or determine the best plan; the best arrangement of subjects; the appropriate time that should be given to each, and such arrangement of subjects as would best suit the classes taught. Not very much has been attained in this direction. I think this should be borne in mind, however, that this, like many other things, will be of slow growth. After all, we should all endeavor, so far as possible, to secure somewhat of this growth; take the things that recommend

themselves to the general concensus of the profession, that present themselves in such a way as to commend themselves thoroughly to the teachers in the profession, and then let them adopt them. For instance, Dr. Weisse has a method that recommends itself to me; it is better than any method I have. Wisdom on my part would be to employ that as far as I can. If we cannot adopt it at once as a whole, take such part as you can and utilize it. If we are anxious to learn, we could in this way make more rapid progress than we have heretofore. There is one obstacle stands in the way in this respect, and that is that those who have been teaching for many years, and along certain lines, have formed a groove from which they find it difficult to free themselves from one method and adopt another; but that ought not to influence the younger teachers. You know how difficult it is to break away from habits of long standing. This is one of the greatest obstacles we meet in securing desirable progress in this matter. If we could all come up to the highest ideal point in teaching and work upon such lines, I am sure we should find our progress, although it has been great, much more satisfactory.

With regard to the subject so fully discussed by Dr. Guilford, that of physics, that is, of course, a subject that commends itself to the attention of every one. We all recognize the principles to which he refers as bearing upon our profession; not only in prosthetic, but in operative dentistry as well. Dentists should understand the principles of the application of force in a great variety of ways. Scarcely ever is a filling put in in which this should not be borne in mind. How is force to be applied to secure the best results, whether from the mallet, hands, or what not? Take a bicuspid tooth where there is a large approximal cavity involving a portion of the crown, a complex filling of that kind, many a time there is failure because of a want of attention in this respect, the application of force. A portion of the occlusal surface sets on the filling, or the opposing tooth comes upon it. It may be a filling well introduced, as far as that goes, but the strain comes upon it at a point that forces it from its position; and many a time, though well anchored, though not dislodged wholly, they are loosened so there is enough space for foreign substances to pass in, and there is a recurrence of decay. In order to avoid that the occlusion should always be noted when the filling is first taken in hand, to

determine whether the occlusion is here or there, and then make preparations to meet that. Secure the filling well in place, and then trim the filling and occlude the point so that there shall not be that exercise of force which shall dislodge the filling. That illustrates the importance of noting the application of force, and how it occurs.

Dr. A. H. Thompson. All teachers appreciate the need that we are in to-day of a uniformity of curriculum in our schools. That has been worked upon to some extent by the Faculties Association, because they realize the fact that the different branches and different years of study create considerable confusion. With regard to students going from one college to another, there is great need of uniformity, and this should be reached by comprehensive methods and studies. But it is a matter that must be reached by evolution rather than revolution. I think we should take the matter under consideration and work toward it; not only toward uniformity, but also toward condensation of our work and the elimination of many things almost superfluous.

It has been suggested that we should require some elementary knowledge on the part of students entering our schools; that they should know something of elementary physics, mechanics, and elementary sciences, just as much as the elementary branches of education; and that it should not be necessary for us to take up the simple principles of physics, and then we can proceed to a further elaboration of their ability which will be more satisfactory.

Dr. Weisse, closing. It seems I did not pronounce the word correctly. I said "few," not "two." I did not say there were only two colleges that gave attention to physics. I said a *few*. I have been much pleased with the corroboration of the views I advanced, —viz, my plea for the study of physics. Now, as a matter of fact, as I stated in the paper, but few students enter a dental institution with a proper knowledge of physics. It may be in the future that preliminary educational requirements will cover sufficiently the knowledge of physics to enable the student to understand many points that have to be explained in college, but, as long as it is not so, it seems to me some attention should be given in the dental curriculum to the subject. Of course, in speaking of physics I do not mean the physics of light, etc., as they have no practical bearing on dental work, but physics that have a practical bearing. Physics are constantly called into play, and must be in the thought

of every operator. If it is not learned as a preliminary, then some direct attention should be given to it in the dental institution.

With reference to the presentation of this subject, it is not intended as revolutionary. I appreciate perfectly, as I have looked at the evolution of teaching in dentistry for the past thirty-five years, that it is a process of evolution. Nothing can be done by revolution, especially in educational matters. Dental institutions have now been in existence long enough to enable us to take an account of stock as to where we stand in the matter of the educational standard of dental colleges. I was asked to present a syllabus for dental curriculum, and I naturally presented a syllabus up to the present time. Of course that presentation covers much of the field covered by dental institutions in their education of men. It is simply a presentation of where we stand. It is simply a presentation of the heads of the subjects, with the scope of knowledge of these special departments which should be understood by the scientific dental surgeon of to-day. That is all. If many deans and professors of dental colleges were to look over this paper they would say, "We have that, and we have that." Of course you have. We all have it. But the question comes up, having it, let us make a statement of it. How many times do we hear it asked, "What do you teach dental students, anyway? Do you teach them this; do you teach them that?" We have gone through the period when it was asked so much. It is asked less now than at first. But it is still asked by institutions abroad, and by the profession abroad, "What do they teach in dental institutions in the United States? Do they teach dentistry alone, or any foundation of general medicine? What do they teach?"

It makes an educational starting point. How is it with a dental student just advancing upon his studies? He is at perfect sea as to what he is to learn. He sees professor of pathology, of anatomy, of operative dentistry, but he is at sea as to the field. But if he goes to a European country he can pick up a syllabus as published by the German government; he can pick up a syllabus of the examination questions he is to answer, and he knows the field he is to cover. Nothing is presented to the dental student of to-day as to the field he is to cover, except the heads of studies and departments. I do not speak of a series of questions, such as the student can cram up on. No, I believe in facilitating the student in every

way possible in getting their education, and I believe you can facilitate that by telling them exactly what they are to learn.

It is not intended that this should be adopted by all institutions in the country. It is simply presenting the scope, the field. It is setting up a landmark, a mile-post, just before the century begins; just now, when we are turning into nineteen hundred, we put up a landmark; this is what is taught by the dental institutions of the United States. All may not conform to it, but it indicates what is being done and the consensus of opinion as to what is required. I request in the paper that it be not left to a single man, but that it be representative; that a committee of three be appointed, and that they select collaborators from the fifty dental institutions of the country, so that the labor will be light on each one. We will ask you to devote four or five hours to it. You can just note down the lecture heads of what you insist on, and present that as a report next year. It might not be perfect; it is not intended to be perfect at once, but it is a starting point. Eighteen hundred and ninety-nine; here we are; this is what constitutes the education of the dental surgeon to-day.

OPERATORY METHODS.

By W. H. WHITSLAR, M.D., D.D.S., Cleveland, Ohio.

If the beloved Professor Chapin A. Harris were called up inspect our dental colleges, he would bless the men of to-da their great zeal and for the wonderful progress they have Colleges are becoming replete with modern invention, fo scientific instruction in dentistry. The strain of the "survival fittest" is upon us, though new schools are constantly seekin mission to the realms of pedagogy.

Encomium upon encomium may be showered upon our dir and trustees for their successful efforts in placing within our as teachers, the means whereby colleges may become perfect o izations. Nothing in this world is absolutely perfect, anc applies quite markedly to the dental college. All are lacki proper financial endowment to establish chairs, which will e creative geniuses to elaborate ideal courses of study and p methods for their pursuance. No college will be complete it can provide amply every facility for the advancement of science, with sufficient and competent "human tools" to en the *ensemble.* Until such time we can approach in a small d only the satisfactory conditions that meet the approval o higher ideals. Dental colleges, at present, are to a large e dependent upon self-sacrificing men to promote their inte these sacrifices not being comprehended by the profession in eral.

The rise of dentistry has given an impetus to its every f and now mediocre methods have given way to systematic tea and the wheels of true dental teaching have begun to revolve.

For the purpose of learning and presenting some of thes tems, it was my privilege to receive from thirty-five of our

colleges generous and kind replies to a large number of questions, some of which, while seemingly insignificant, were used as leaders to glean ideas which might be useful to others, particularly in reference to the work of the infirmary.

Dental colleges in this country have operating rooms both large and small, containing from nine hundred and sixty to ninety-six hundred square feet, averaging from forty-nine to one hundred and fifty square feet for each operating chair. The shape of the room is usually rectangular, which seems to afford better facilities for light, unless situated at the top of a building and lighted also by skylight, when a square room is simply ideal. About two thousand chairs are in use in our dental schools, ranging from nine to one hundred and fifty in each, and used by seniors, juniors, and freshmen. With the exception of one, all schools allow juniors to operate, and one-third of our schools allow freshmen to do minor operations, such as the cleaning of teeth, etc. In a few colleges juniors have special chairs, one or two have special rooms for juniors, others alternate with seniors, or, juniors operate in the morning and seniors in the afternoon. In all colleges seniors operate, but in some their requirements must be fulfilled in January in order that the juniors may occupy the chairs the remainder of the session. This indicates a system of doubling which is *not* ideal. We believe that seniors should operate during the entire year, and each day in the session. While our colleges have chairs equal in number to but two-thirds the number of our seniors, careful management would enable each and every senior to have daily practice. An increase in the number of chairs in some colleges would make this method practical. Those in charge of the operatory find the numbering of chairs a great assistance. In our own school, where every senior retains his chair throughout the year, we have placed on the wall before each chair a neatly printed card containing the name of the senior, and patients often save time by inquiring for the student by name. In our opinion, juniors should operate, but admission to the operatory should be governed by the completion of their work in prosthetic and operative technics. Freshmen should not be allowed to operate.

Attendance in the operatory may be kept by the clerk or demonstrator, roll call, noticing absentees, attendance cards, which may be handed in to the clerk with student's own signature, or by at-

tendance cards, punched by the demonstrator in chief. The amount of work accomplished, and not attendance, is the requirement of some colleges. The principal requirements of the operatory consist in the filling of teeth, their treatment, minor oral surgery, and dental orthopedics.

Most colleges require a certain number of fillings ranging from six to one hundred gold, six to fifty amalgam, five to fifteen cement, five to ten gutta-percha, and no more than fifteen tin fillings are required in any one school. Many schools do not require any tin fillings, which is, we think, a grievous mistake.

As a further requirement, treatment of abscesses, pyorrhea alveolaris, gingivitis, and a limited number of cleanings of teeth comprise the list. Satisfying demonstrators of their ability, or requiring students to do all they can, without limit, are methods pertaining to seniors in some colleges. One of the best systems devised for regulating the minimum amount of service in the operatory is known as the "Count System," devised, I think, by our esteemed Professor Black. It is based upon the value of "points." The simplest kind of a cavity filled means one point. From one to fifteen points can be gained by the operator in a single operation. To illustrate further,—approximal cavities in incisors and cuspids count from three to five points, occluso-approximal cavities in bicuspids and molars from five to eight points, and so on, increasing as the case merits skill and labor. The operation in each case is passed upon by a demonstrator, who issues cards to the students, which must be handed to the clerk of the clinic before credit is given for the operation. The full number of points required of the senior students in one school is one hundred and twenty-five in gold fillings and one hundred and twenty-five in amalgam. For the juniors, sixty-five points in gold fillings and sixty-five in amalgam. In another school two hundred points in gold and fifty in amalgam are the requirements for seniors. Fillings of other materials are gauged by number rather than by points.

A diversity of answers was received concerning our query as to how to prevent waste of materials. "Would like to know" and similar replies were given. One college provides bottles for the waste gold, and another deals it out in small pasteboard boxes, which are returned to the clerk with the remnants. Colleges which sell their materials to the students or patients before the

operation avoid the waste, but at the same time give the student an opportunity to secure a fee for himself.

Capsules containing from five to ten grains of alloy subserve a useful method to prevent waste of that material.

A very practical economy in the use of medicines has been followed in our school by giving each senior, at the beginning of the year, a portion of each of the medicines most commonly used, he to provide his own bottles. We allow from two to four drams of each of eighteen different medicines, which, when exhausted, must be replenished at the expense of the student. The college medicine case contains a complete variety of medicines, adapted to special cases, which are furnished to the students upon application.

Systematic teaching, with a heterogeneous supply of operating instruments among the students, is an absolute impossibility. Uniformity of sets of instruments, well selected by the management of the college, is a necessity. To facilitate work the instruments should be numbered, so that demonstrators may save time by calling for them by number. They should also be numbered by the metric system, thus teaching form, size, and strength. Another advantage in the metric system of measurements of these instruments lies in the student's ability to secure exact duplicates from the manufacturer.

The extracting and surgical clinics are most frequently neglected, graduates often having had little experience in this important department of learning. To accomplish the teaching in this department satisfactorily, classes should be divided into sections of not more than three students. Each section does duty upon date of its assignment, and all cases presented during its service are property of the section.

By all means a skilled demonstrator should supervise this work, and no case should be operated upon unless he is present. In this way *only* can systematic instruction be given in extracting, surgical cleanliness, preparation of local anesthetics, and the use of general anesthetics.

An examination room, says one of our best teachers, is a necessity. It prevents interference with students who are engaged in operating, and it serves to facilitate matters.

Let me suggest that students, in rotation, perform this service as examiners in connection with the demonstrator, this service to

constitute their whole duty on the days of their assignment. vide a special examination chart to be filled out and duly a before his demonstrator, which will also serve as a guide student to whom the case is assigned. This plan is now in tion in the college with which the writer is connected, and i ing with much favor.

The assignment of patients is one of our greatest pr This is done alphabetically, according to matriculation, ac to the amount of work performed, according to the ability student for that special work, by the available students, those having the fewest counts. The work of assigning p is performed by the superintendents of the clinic, or by dem tors in whom should be embodied keen perceptions an intuition with enough strategic ability to keep the stud touch with their work. One experienced demonstrator can ten students entering the operatory for the first time, provi has no other duties to perform, and, as their experience in and they require less constant attention, he can increase th ber to twenty-five.

In former years classes were more variable, but now fle toward the great purpose of our work is increasing, as hig quirements are made for entrance to our colleges.

Mention of the methods of keeping records of our work h purposely omitted from this paper, because they can be studied by a perusal of the various charts which have been m upon cards and placed among the technic exhibits. From t can all see which method most fits the needs of our own sc

It affords me great pleasure to thank the various offic their courteous attention in replying to my letters of inqui I trust that the seed they have sown will bear excellent fr the work of the operatory will increase in usefulness, a through our conscientious efforts to systematize our teach shall elevate our chosen profession and send out into the worl proficient dentists.

DISCUSSION.

Dr. W. E. Wilmott. Several members have asked explain the methods adopted in our infirmary, and I have these gentlemen to kindly distribute to you a copy, which explain to you in a few moments. This subject possibly

interest to few of those assembled, but it is not the less important. It is not exactly a method of teaching, but I claim one of the minor objects of the association is to teach the students methodical methods and ways of doing things. If our laboratory is carried on in a careless, slipshod manner the student becomes so himself; but if we have a system it is a good thing for the students.

It is surprising to know that some schools count the amount of work done, and not the attendance. I think that is a great mistake. There are students who work with the idea of doing the least possible work in the least possible time. A student should be compelled to be in the operating room a part of every day at least.

I have nothing particularly new, but I hope some of you may get some ideas from it. I have been improving for ten years, from time to time, but I realize it is anything but perfect. Our idea is that the keeping account of material, etc., should be as light as possible for the demonstrator. This is a description of the methods employed in the operating room,—the dispensing of the supplies and keeping account of them, and the manner of keeping account of the value of the material used.

(The speaker had a card showing the means by which an account of the materials used, etc., was kept for each student. The manner of using the card was fully explained by reference to it.)

Dr. D. M. Cattell. I am a believer in system, too. I do not like the word "infirmary." It is in the profession, however, and we cannot very well overcome it. (Making illustration) Infirmary consists of operatory department, prosthodontia department, orthodontia department, crown and bridge department, surgery department, etc. There you get my meaning. I do this because a member asked, Why "operatory"; why not infirmary? *Infirmary*, it seems to me, includes the whole clinical department, so to speak, of our colleges, and that department might be subdivided into operating room, prosthetic room, orthodontia room, crown and bridge room, and so on. I agree with the writer of this paper, and I have no special criticism to offer on the paper at all; but it does not take in the scope I had supposed it would. I am very much disappointed in it in that regard, because I had hoped that the writer would formulate a system, somewhat ideal, to present to us at this meeting. I agree with the paper that no student should be allowed in the "operatory" until he has finished his work in the technic de-

partment, whether senior, junior, or freshman. In the clinical department I like to see an appointment book properly kept, just as we have it in the office; and in that appointment book the patient's name, the hour at which the patient is to be received, and the operator that is to meet the patient. In regard to material, we should sell the material to the patient, not to the student; the student acts as agent between the patient and clerk, after the demonstrator has passed on the cavity. At that time the demonstrator indicates upon a little "material card," by writing in figures or otherwise, the number of rolls of gold or other material that it will probably require to fill that particular cavity. We use No. 3 gold, college rolls, so called. That is, each sheet is divided and made into three rolls, so that if a cavity requires seven or eight rolls, that amount is marked on the material card, and the patient knows how many rolls are required to fill the cavity. The operator tells the patient the price per roll, and the patient pays the operator the money, who carries it to the clerk and buys the gold, carrying it to the chair in a special box, the patient knowing exactly how much gold has been bought. At the end of the operation, if there is any gold left it is returned in the special gold box to the clerk, who refunds money prorated in fifths of a roll. When through, whether there is any left or not, the box is returned to the office. All scraps of soiled gold are dropped into the box during the operation and returned to the office. We have in the Illinois School of Dentistry so far this year made a considerable saving. We have received quite a little bit of soiled gold. We had no idea there would be so much returned.

The classes are divided into four sections, both for operating work and extracting; one section coming on one day, and another the next, so that one section never comes repeatedly on the same day of the week. However, that does not deprive the students in other sections from doing work if they have it to do. But the section for the day receives all the new patients that come on that particular day. We do not assign to students a particular chair for the week or for the day, but any chair that is vacant he may select; and the chair with certain space around it is for the time considered his office, and he must treat is as though it were his private office. He must watch that no soiled paper or rubbish of any kind is thrown around, and if it is dirty when he takes the

patient to the chair he must see that it is put in order before he begins work; and he should act as though the patient, chair, space, and money coming was for his private and special benefit.

Years ago dentists had examination blanks in their offices. I think if you were to travel over the country now you would find very few dentists who used examination cards or blanks. They are somewhat of a dead stock in supply houses, and only used today in dental schools for other purposes, with probably few exceptions. I don't believe in much red tape, circumlocution, or whatever you wish to call it. I think the more simple the system for demonstrators and students the better. We simply use these charts that you are all acquainted with (exhibiting), and as the work is done the student writes the date, patient's name and address, and designates on the chart the particular tooth or cavity in pen or pencil; then writes near it "gold," "amalgam," or otherwise, as the case calls for. This is all done by the student, who also signs his own name. The demonstrator, before the patient is dismissed, examines the case finally. He has seen it many times during the progress of the work; then he determines what that filling is worth in points, one, five, eight, or ten points, whatever it may be; and, as the paper indicates, the greater amount of work and the more difficult it is, the greater number of points may be allowed. If it is as perfect as we would expect a student to do, he should be given the benefit of the full number of points allowed. It requires but a few moments' time for the demonstrator to look after these "credit slips" and sign his name thereto. That record is passed to the clerk by the student, and filed away until a certain night of the week, when that demonstrator goes over them all in this manner, marking it in a book (showing on blackboard):

STUDENT'S NAME.

Pts. gold............................
" amal. ....
No. Tin fillings.......................
" Cement fillings..................
" Gutta-percha fillings..............
" Cleanings ....
" Extractions ....
" Treatments ....
Etc.

Dr. TAFT. When does this record begin?

Dr. Cattell. At the beginning of the term. Of course, in the beginning a student may not get a credit of more than five points, where after a while he might receive eight points on a filling. Eight points is the highest one can receive on a filling, except it be, as this little book of rules will indicate, a case where the interproximal space has been lost and he has to wedge the teeth apart and restore that interproximal space; then he is allowed as high as twelve points. The demonstrator may allow, in his mind, say, on a filling six points at the time the filling is inserted. In the polishing of that filling, if the student has destroyed the point of contact, one-third will be taken off the original count.

Dr. Hoff. Do you make the final decision on the number of points?

Dr. Cattell. After the student has made the number of points required in gold, it is at his own option whether he does further work.

Dr. Hoff. You put no restraint on him in the number of times he attempts to accumulate that point. He can make a hundred fillings, and you say the maximum is eight for each filling?

Dr. Cattell. If at all passable, the minimum number of points, one; maximum, eight points. Some classes of cavities filled are worth more in points than others. Simple cavities, few; complex, many.

Dr. Hoff. You allow him to work until he accumulates a number of points sufficient to pass him, regardless of the number of attempts he makes?

Dr. Cattell. He must make a hundred and twenty-five acceptable points, whether he accumulates them in small figures or large. It is the *points* that are counted, not the fillings. The more difficult the operation, the greater value it has in points.

Dr. Hoff. Then I don't think the system a just one.

Dr. Foster asked for suggestions as to how to prevent students taking patients to their rooms and operating on them there. He stated he had had trouble in this respect, and desired information as to some means to prevent it.

Some one suggested that the way to prevent it would be to expel those who did it.

Dr. Whitslar then closed the discussion as follows: I am in accord with Dr. Cattell in being disappointed with the paper. It is

not what I expected to write. I procured from fifty-five colleges reports from only thirty-five. If I had had reports from all it would have been very different, and could have made a composite system whereby all colleges might follow its use. We have large and small colleges. What will apply to a large college will not exactly apply to a small one. But I feel quite amply repaid for the time and work in looking after this matter in procuring these little charts we have about the room, because some of them present very valuable features. The chart of the Illinois College is excellent, and worthy of the closest scrutiny. The charts of the University of California and the Minnesota College have some fine features.

THE USE OF TEXT-BOOKS IN CLASS WORK.

By OTTO ARNOLD, D.D.S., Columbus, Ohio.

We have for consideration to-day the subject of books; not, however, under their usual significance as means of information, culture, or recreation, but as technical tools used in our educational institutions.

To the "Century Dictionary" I am indebted for the following definition of the term technics: "Things pertaining or relating to the practice of an art or science." Under this definition books, in an eminent degree, become technical instruments, and their proper use therefore as pertinent a subject of inquiry in this assembly as if they were composed of steel instead of ideas represented by printers' ink.

This taken for granted, I shall proceed to a discussion of the advantages arising from the use of text-books in class work, believing the method to be in accord with the theories of pedagogics which represent the foremost thinkers of the age, and the one which results have shown to be most practical in our best schools.

All colleges unite in placing standard text-books in the hands of their students; the only question at issue is how best to transfer the contents to the brains of their owners.

In the institution which I represent we have adopted the recitation plan in preference to the method generally known as the lecture system, believing that in this way we obtain a more thorough preparation by the student principally through the instrumentality of text-books, lists of which are furnished by the authorities of the school. But just here I wish to put ourselves on record as not depending upon text-books alone, least of all upon any one text-

book; that would be to make shipwreck upon the shoals of Scylla after having safely shunned the whirlpools of Charybdis.

"The proper combination of oral teaching and book study," says a noted lecturer on pedagogics, Professor E. E. White, "is one of the profound problems which confronts the teaching profession of to-day." Some strongly advocate one theory, some are firm believers in the other, but on the whole the wiser ones agree that both are absolutely necessary. Goethe's aphorism declares that "thought expands, but lames; action narrows, but intensifies," and we must neither *narrow* nor *lame*.

What, then, are the advantages in the use of books in class work, and what are the best methods for bringing this about? In the first place, the use of books in all instruction is natural and customary to the age in which we live, and to neglect the value of this powerful "fourth estate" would be "worse than a crime; it would be a mistake." In the days of Homer legends and songs were transmitted unchanged for generations, but who on that account regrets the invention of the printing press?

It has been said that if the Bible had been blotted out of existence it might in comparatively modern times have been reproduced from the memories of the devout Scotch Covenanters, but such feats of sound reproduction will never be heard in the dawning twentieth century unless by the aid of the phonograph. *Visual* images are the ones most readily recalled by the majority of people. Sight is sometimes called the regal sense, and Thoreau even said, "Of the five castes, sight is the Brahmin caste." If this is a scientific fact, advantage should be taken of it. Repetition is another factor in impressing details. To a sluggish student, hearing a fact once may not be sufficient to fasten it in his memory, especially as his attention is divided between listening to the argument and jotting down notes for future examinations, while the same student may doggedly pore over his text-book until the meaning becomes clear. Then, if the student misses a lecture it is irrevocably lost under the lecture system, while under the recitation plan it may be partially bridged over by keeping up the connection in the text-book. Yet we do not find, even with this possibility, that absence from class is increased by the recitation plan; on the contrary, its use makes attendance almost obligatory, as unexcused failure to respond means zero upon the record. *Attention*, also, is naturally increased

if one wishes to make a reasonable showing before his f
students; so, with a gain in *attendance* and *attention*, we clai
powerful factors in favor of our system.

When it comes time for a review the regular manual, w
comprehensive summary, is much more to be depended upo
random notes, often inaccurately taken and poorly preserved

There is also much more likelihood for preparation w
student is responsible for a certain assigned topic upon wh
may be called for discussion, and his actual standing in hi
thereupon dependent. Day after day, "no day without a
he goes on, and at the end of a three or four years' course the
subject has been passed over. One step at a time seems slow
but it is the universal law of human progress; and if a pupil h
slightest degree of earnestness his text-books will stand as
stones to mark his advancement, and will form no small part
practical capital for future use.

But it is evident enough by this time that the main use
text-book by the pupils is outside the class room, to prepare t
enter intelligently into the discussion of the topics assigned.

"Learning is the result of self-activity," should be blazo
the walls of every educational institution. Only can the ho
built by the teacher when the foundation has been prepared
pupil himself.

"The recitation plan" is a very flexible title, meaning a
all means of presentation in which the student bears an acti
instead of being a passive listener. This may take the f
questions and answers, illustrations, practical demonstrations
on occasion, the recitation plan may be set aside for th
being and an extemporaneous or carefully prepared lecture
given. All this is instruction, and in all cases falls upon t
ground when the subject has been carefully considered by th
scientious use of a text-book to familiarize the learner with te
terms and general principles. In the class room mistaken c
tions are corrected, a thorough revelation of each one's st
disclosed, and delinquents reported before reformation is t
In short, by this means pupil and teacher come into much
contact than is possible under any other system.

This brings us to "the other half," the use of the text-book
hands of the instructor, upon which much of the success
whole matter depends.

He first makes a careful survey of the whole field, laying it out roughly, according to the number of recitations at his command, eliminating all portions covered by other chairs (for few of us now occupy a whole settee, as did at one time Oliver Wendell Holmes). He will give attention to *proportion* in considering the claims of the remainder for consideration. A good teacher will omit from or insert portions into and rearrange *any* text-book, no matter how excellent, according to his own individuality and the characteristics of his pupils. Then comes the assignment of the lesson, a very important part of the work; to give just as much *and no more* than can be readily digested at one sitting. After this, and still more important, is the daily and specific preparation on the part of the teacher. No one can omit this and keep his own interest, to say nothing of that of his hearers.

The subject must come fresh from his mind, though taught scores of times. In fact, "the barrel" is the greatest stumbling block in the path of the lecture system; a danger not so peculiar to the recitation plan, where every answer tends to sway the current of thought. Then comes the summing up, when the use of the text-book is revealed on the part of both pupil and instructor. The skillful leader will sift out the essentials of a chapter, omitting matters of small importance, comparing, condensing, elaborating, illustrating; *this* is, in short, what we consider using text-books to the best advantage, and one that is growing in favor in all schools that have given the subject the consideration which it demands.

"There has been much discussion," says President Eliot, of Harvard University, "about the comparative merits of lectures and recitations. Both are useful; lectures for inspiration and guidance, recitations for securing and testifying to a thorough mastery on the part of the student of the treatise or author at hand.

"Recitations alone degenerate into dusty repetition, and lectures alone are *a useless expenditure of force. The lecturer pumps into sieves.* The water may be wholesome, *but it runs through.* The discussion about lectures and recitations has brought out some strong opinions about *text-books and their use.* Impatience with text-books and manuals is very natural in both teachers and taught. These books are indeed, for the most part, very imperfect, and stand in constant need of revision. *But it is a rare teacher who is superior to all manuals.* Scientific manuals are, as a rule, much worse than

those upon literature, language, or philosophy, *yet the main im*
ment in medical schools during the last twenty years has be
addition of systematic *recitations to the lectures which wer*
merly the principal means of instruction."

Finally, one important influence which we must not ove
though an indirect one, is *the habit of using books* as aids in p
sional study, a habit of tremendous importance in determinin
mental status of the graduate in his whole future career.

The art of mastering the printed page, like that of all othe
depends upon diligent practice; in fact, can be acquired in no
way. Some educators declare that in the present prevale
oral teaching in the city schools the decrease in the power o
study is readily perceived. If this is the case, there is in
loss, and one which we can ill afford to suffer. The man w
lay his hand at will upon his scientific authorities, as a soldie
his trusted weapon, is armed in advance for many an unex
emergency which would otherwise result in mortifying
Garfield's famous definition of a university has often been q
"Myself at one end of a log and Johns Hopkins at the other
But may we not also speak a word for the firelit cabin in
Abraham Lincoln graduated, where he and his book were
the same end of the log?

We have not exhausted the possibilities of the subject a
us, but enough has been said to indicate what are to us the m
savings in time and energy in the use of a comprehensive,
written text-book. We do not use this as an oracle or insp
but simply as a guide-book, a Badaeker, if you please, to
in the general details of our journey and spare us time and n
labor. We may not wish to stop at all the points he indicat
may linger where he expects us to make only a day's visit,
the whole we greatly rely on our wise counselor, and gladly p
selves under his guidance, satisfied that, though the way
and the journey sometimes wearisome, the direction at least i

SYMPOSIUM ON TEXT-BOOKS.

PROSTHETIC DENTISTRY.

BY DR. I. N. BROOMELL, PHILADELPHIA, PA.

I take it as my privilege in occupying a portion of the time assigned me to make reference to that which is good, bad, and indifferent in our text-books on prosthesis; to uphold the good, to condemn the bad, and plead for the indifferent with a hope that it may be better. Correctly defined, a text-book is one containing the general principles of a given subject primarily designed for students. A student, in the general acceptation of the term, is one devoting his entire time, or nearly his entire time, to the study of some special branch of science or art. Literally, all who study are students, whether the application to books be made within the walls of an organized place of learning, at home, in the office, or on the street. In the first class we recognize the *bona fide* student; in the second the graduate, the practitioner. There is but little doubt that dental text-books, particularly those which obtain to operative and prosthetic dentistry, are prepared with the idea of meeting the demands of the actual student, and I shall so treat the subject. In one particular our text-books on prosthesis are of about equal value; that is, in the scope of the work, in the "table of contents." Here we find a short treatise on metallurgy, the methods of applying and generating heat, a chapter devoted to the preparation of the mouth for an artificial denture, the materials used and the methods employed in taking impressions, forming the cast, the making of die and counter-die, the mounting of teeth, the use and management of plastic bases, crown-work, bridge-work, etc. These subjects, with possibly a few others, appear to furnish a foundation sufficient in most instances to result in a book of no mean proportions. In this respect, therefore, there appears to be but little cause for complaint, unless perhaps it be the disposition to augment the volume by the

introduction of those chapters that might to better advantag taken up by works specially devoted to the subject, includ these being metallurgy and the preparatory treatment of the m

The marked advance in the teaching of prosthetic dentistry i last few years certainly cannot be measured by the number of books on the subject, for at the present time they are quite li in number, and those most recently published being one of a of volumes intended as a systematic treatise by various au covering the whole domain of dental practice. It is a questi to the best methods to pursue in the compilation of text-b That is, should they be largely the work of an individual, o result of the combined efforts of many? In the first we recognize the disposition for the book to be unduly devoted t methods and principles most respected by the author; in the se while the various subjects are contributed by different wr there is a possibility, if not an inclination upon the part o editor to so revise and rearrange the subject-matter thus tributed that the completed volume throughout appears almo coming from the pen and the mind of an individual. Aga must be recognized that those who have devoted much tim labor in a special direction are best suited to treat upon specialty; but in many instances, particularly in prosthesis, who possess a valuable working acquaintance with most oper in detail have not the qualification of communication to other clear and comprehensive manner the secret of their handiwork

Again, in the former instance, the one-man book if you p the author may be possessed of great volubility, which accomm ing faculty, although a happy one in many ways, does not a result in a book full of good things. In such a work one is pelled to read much to obtain little.

Still another class is that in which the author lacks both bility and composition, the inevitable result being a book abou in citations; quotation marks being strongly in evidence.

Of these two evils, however, the latter is much to be pref for by a careful compilation of practical ideas from practical recorded as originally communicated, a valuable and useful duction will result.

Now let me refer to some matters pertaining directly to our books on prosthetic dentistry. In the first place, this bran

dental training could be greatly improved by the introduction of a work the character of which might be included within the title "Prosthetic Technics." My reason for offering such a suggestion is as follows: The present works upon this subject may be said to pertain to the principles and practice of prosthesis. In these we find a systematic treatise of the subject, a treatise covering both theory and practice in minute detail. Such a book is well adapted to the advanced student, or even to the practitioner who desires to become thoroughly conversant with a given or with the general subject. For the beginner such a book is too voluminous, too much reading being required to obtain the desired working details. It might be suggested, therefore, that the gradation of books be in keeping with the gradational nature of the work, the ideal book for the beginner in prosthesis being one which adheres strictly to technical procedures, avoiding all that might tend to confusion and complication. Such a work might be classed as the intermediary between the compend and those standard volumes at present in use, and might be so arranged that it could be utilized in class or section instruction, serving as a working guide, and carrying the student step by step through his entire technical course.

With reference to the modern books on dental prosthesis, too much cannot be said in the way of praise for the admirable illustrations with which they abound. A written description, however carefully prepared, is necessarily more or less imperfect without the aid of illustrations to assist in carrying out the theme. It has been inferred that in very many instances text-books suffer from over-illustrating. However this may be in works of a general character, it can hardly be applied to those devoted to mechanics, for the foundation of all that is mechanical lies in diagrammatic delineation; therefore there is no branch of dental teaching in which the illustration serves a better purpose than in that under consideration. I desire to refer to the disposition to overwrite certain subjects of minor importance to the detriment of those of much greater significance. A proper judgment in this respect must be looked upon as one of the keys to success in book-making.

In conclusion, I desire to call attention to the many complications and misinterpretations that accrue from what may be considered a lack of attention to our nomenclature. In this the writer has no choice, the nomenclature itself being at fault.

There is probably no other descriptive term more confusi the student than that used in describing the depression form the palatal side of a plate, and variously named a vacuum cha an air chamber, or a suction chamber. Practically this is of importance, but theoretically it causes no end of trouble t teacher. To remedy this, however, we must first decide as t nature of this cavity when in the mouth.

Another is that which refers to the coming together of the both occlusion and articulation being used to describe this pr The terms cast and model are used synonymously when refe to the plaster form produced from an impression of the m While it is doubtful if either of these expressions is literally rect, the latter term, "model," is undoubtedly the most accep especially when we consider that the former term, "cast," m used most appropriately to describe the act of running fused into a mold. To them might be added other terms used sy mously, many of which are entirely misapplied.

DENTAL PATHOLOGY.

BY DR. A. H. THOMPSON, TOPEKA, KANSAS.

The old-fashioned, heavy, padded text-book, like the fashioned, heavy didactic lecture, must go. It will soon be gated to the limbo of things obsolete and useless. It is not i mony with modern methods of teaching, nor with the ch conditions of modern dental education. A mass of wordy r is offered to the student that is too often irrelevant or indire diffuse, so that he is confused and misled, and fails in his effo extract the kernels of facts from the mass of chaff through he must wade in his search for knowledge. The student rea studies these heavy text-books, and often very faithfully, but to the class-room with very vague and imperfect ideas of th jects treated of. There is a want of the elements of concis simplicity, and directness in our text-books, which are so ess to ready learning.

The ideal text-book of dental pathology, and of every branch of our curriculum, for that matter, should deal with th subject alone, and nothing else. Why, for instance, should a

book on dental pathology be padded out with chapters on general anatomy, dental anatomy, physiology, and materia medica? But the merest general outline of these extraneous subjects is or can be given, and these are treated in a better and more thorough manner by books devoted especially to them. The condensed account given of these outside subjects is of no use to the student, for he has special books on them; or it sometimes has the bad effect of causing the lazy and illiterate student to think that these brief chapters are sufficient for the study of great branches. Besides that, these other subjects are not dealt with to any extent, or should not be, by the chair of dental pathology. The lecturer and teacher of dental pathology has quite enough to do to cover his field, if he does it at all well, without dragging in subjects which are more fully taught by the special teachers of those subjects. The text-book of dental pathology should deal with that subject alone, and nothing else. One book for one subject. Leave other fields to other special books by specialists upon those branches. The work will be better done, and the general smattering on general subjects avoided.

Of course the ordinary heavy text-book is made to sell, without much regard for the requirements of the student. The author is often induced to expand his material "a little more," so he drags in irrelevant subjects to make extra chapters to pad it out. So what should be a two- or three-dollar book is expanded to a five- or six-dollar book, in order to sell for more cash. But, as a matter of fact, this is a mistaken idea, for as a commercial venture the smaller book would be more profitable. Five or six students will buy a two-dollar book where but one or two will buy a six-dollar book, so that the smaller would really pay better than the larger book.

The next requirement of our ideal text-book would be that each chapter should have questions attached to it which are answered in the text, like some school books. These are excellent helps for self-examination by the student, for quizzes, and for the teacher for recitation and for examinations. As the quiz supplements the lecture, so the questions to the chapters supplement the text, as after helps. They furnish a constant review of the subject that the student applies all the time, and avoid the use of that abomination of the teacher, the quiz compend.

When we attain the ideal method of direct recitation by the scholar, instead of the old-fashioned didactic lecture, such ques-

tions will be indispensable in our text-books, as they are i regulation text-books of our preparatory schools and colleges us hope that our text-book writers will adopt the plan of a questions to their chapters for these purposes.

The text-book of the future must be small, say two hu pages, or, at the most, three hundred, and must be concise, s and elementary. The average student comes to us with experience in systematic study. Very often he has been c school so long that he has lost all of the habits of study that h did have. Some are advanced to years that make study c hard, because the impressible years of youth are passed. For classes of students our text-books should be elementary and c and as little diffuse and argumentative as possible. Students be taught as children, beginning with the simplest things, fo preliminary knowledge of our sciences can be presumed. acquisition of knowledge by the average dental student is a p process at best, so that it is manifestly cruel to impose on hi necessity of wading through a mass of material that requires of experience to study discriminately. Of course, the larger books are necessary for the advanced student of specialties, b for the beginner. Therefore, we make the plea for more co simple, and strictly restricted text-books for the dental studen

DENTAL THERAPEUTICS.

BY DR. JAMES TRUMAN, PHILADELPHIA, PA.

Were it not that this has been prearranged by the committe not a personal selection of a subject, I might very prope charged with an egotistic assumption of superior knowledge. ing, however, no choice in the matter, I propose to give my as briefly as possible.

It has always seemed to me that the writers of text-books few exceptions, in medicine and dentistry have aimed to books rather than to impart knowledge. I mean by this tha had in view (1) the size of the book, (2) their own reputati profundity of knowledge, and (3) in order that this mig emphasized innumerable quotations must be made from au The necessities of students are apparently rarely considered.

The minds of those for whom these books are intended are like those of children, presumably receptive, but only capable of absorbing simple problems. To insure this the language used to convey these ideas must be of the clearest character, and be largely divested of technicalities. If the teacher or the author exceeds the measure of the student's capacity to absorb his teaching or his book, the work fails to that extent. The Germans, who have reduced pedagogy to a science, understand this better than most other nationalities. In their teaching they aim to instruct the weakest mind in the class, and the teacher works with this end always in view; and if, at the close of a half-hour's lesson the dull boy has failed to comprehend, the entire lesson has to be repeated, to the disgust of the brighter students.

Now this, it seems to me, should be the rule not only in our classes, but in our books, always writing and talking to the comprehension of the dull reader or student. Text-books, as their name implies, are books to be used for reference by this class of mind; hence there should be a unity of effort between the writer and teacher, and both work in harmony for the benefit of those for whom the work is intended.

Redundancy of words is a positive evil in our text-book writing. It seems to be forgotten that words are tools to formulate ideas. Pages will be taken up with an attempted explanation of the etiology of a subject, and then will follow a maze of words as to treatment, in which the therapeutics are so completely jumbled that the poor searcher after facts lays down the book in disgust. He is met with technical terms in a language unfamiliar, and this at once impresses him with his profound ignorance and with the feeling that he can never master the difficulties presented. Discouraged, he seeks the dictionary, but that fails to enlighten him, for he is met there with obscure definitions, made doubly so by technical terms. By continual repetition the struggler after knowledge may succeed in absorbing the true meaning of the author, but only after a waste of time and energy. Who of us have not experienced a vacuity of intelligence after listening for an hour to a scientific lecture, not understood because the teacher failed to comprehend the first principle of teaching, simplicity of diction?

It is probably true that not one of us, who have devoted our lives to teaching in professional schools, deal with words as we should.

Medical and dental nomenclature is necessarily a very s
study, and it becomes the duty of the teacher, and in this ca
the writers of books are included, to adopt the method th
impress the idea sought to be conveyed by the word, rathe
the word itself. To illustrate my meaning, if I have occas
use the word "metabolism," and that be used without explar
almost the entire class would be in a mental fog; but if I w
begin with the changes that this word typifies, and seek to de
and show how these occur in tissues and the formation o
products, before giving the word, it seems to me the idea wo
so firmly impressed on the mind that when the word metal
was given it would be firmly fixed upon the memory. The a
intellect must grow into a word. Some grasp these with eas
are by nature linguists; but these are comparatively rare, and
fore the needs of the majority must be supplied.

The use of foreign words, unless they have been adopte
the English language, should never enter professional w
The author may be learned in the languages, and be tempted
a word more expressive than is to be found in English; but
not only indicates bad taste, but renders the meaning confus
the average reader.

Another serious evil in book-making is the tendency to e
matter not strictly belonging to the subject the author has atte
to explain, and which could be better studied in books devo
special topics. Some recent writers have avoided this, but
have not. To illustrate my meaning I allude to one work,
the late lamented Dr. Garretson, in the mistake he made
"Oral Surgery" in including "operative dentistry," thus r
the book unwieldy and of lessened value.

The subjects included in medicine and dentistry have b
specialized, and should be treated with that view constan
mind; and if a collateral branch must be alluded to, it sho
done as briefly as possible. If it be a work on dental patho
is unnecessary to enlarge on embryology or bacteriology, fo
are specialties, and demand exact investigation in broader fie

In no branch of dental study is there more deficiency man
than in the therapeutics of our text-books, and to this may
be ascribed the lack of uniformity that exists in regard to trea
There is not a text-book on dental pathology that the teac

that branch does not hesitate to place in the hands of the student. This is not explainable by any lack of knowledge on the part of the writer, but is largely due to a want of harmonious agreement as to methods; and this lack of uniformity runs through dentistry as a whole. There is a certain "go-as-you-please" method that does not add to our reputation as a scientific body. It is not necessary to multiply instances, for they are all around us in our teaching and in our books.

In our therapeutics it would seem that writers take it for granted that students are perfectly familiar with drugs and the uses to which they are applied. This is probably true with the trained reader, but I understand text-books to be written for the use of undergraduates.

Let me illustrate my meaning. If the writer undertakes to describe the treatment of pericementitis, he will probably say of counter-irritation that capsicum, cantharides, mustard, iodin, aconite, terebene, etc., may be applied. No distinction is made as to the difference in properties of these various agents, or to the effect produced, beyond the mere fact that they irritate the mucous membrane and produce new centers of inflammation. My idea would be to take these separately, and discuss their various effects and proportionate values. When a writer says, "Use iodin in pyorrhea alveolaris," why does he use it there? The reader is left in the dark, and feels that its use borders very closely upon empiricism. Is it placed there to excite the glandular and absorbent systems, or is it used for its antiseptic properties, or both? If it be trichloracetic acid, lactic acid, or sulfuric acid ordered upon the same lesion, why is it not stated how these should be used? If it be aconite directed to be placed upon the pulp, and especially upon the peripheral circulation in pericementitis, why not state what is supposed to be effected by this agent in aborting inflammation? Does it act as an irritant, or does it paralyze the sensory nerves, and, instead of producing a desired congestion of the vessels at the new center of irritation, an anemic condition is the result? Does he state, in a word, the object to be attained by the use of these agents?

How many treat pyorrhea alveolaris upon a system based upon its pathology, as far as that is understood? From the descriptions in our text-books the conclusion must be reached that not only is no system followed, but that which is used is frequently injurious, defeating the object of all therapeutic treatment. The true prin-

ciple, as I understand it, is to treat all conditions presenting. lesion is rarely the result of a single cause, as in pyorrhea. have here a phagedenic destruction and a bacterial invasion conquered, and the idea that any single application of a drug accomplish this is a fallacious conception in therapeutics.

This is equally true of counter-irritation. Here is dema an intimate knowledge of the effect of irritants upon sensory n and the result of the afferent and efferent impulses to and the nerve-centers. It must be understood, as previously s that a moderate irritation produces an increased flow of bloo congestion of the part, and thus dividing the supply of blood given area, relieves the pressure at the focus of inflammation then, powerful escharotics be used, the effect desired is measu lost by destroying these nerves, together with the vessels exp to receive the extra outflow. This explanation is simply illu tive of what should be taught in the books, as thoroughly as supposed to be taught in the lecture-room. I, however, f find it there. The result is that our whole therapeutic pract honeycombed with inconclusive methods.

The same definite description should be used when sys treatment is indicated. It means but little to say give so mu opium, or its derivatives, or so much of aconite and other a or certain purgatives. What the student desires to know is these are used, and the effect expected to be produced by These detailed descriptions may be regarded by some as pedantry and beneath the dignity of the author, but if we are teachers worthy the name, we must cut loose from tradi methods and make our books and our teachings correspond wi mental powers of those we propose to train. In proportion write for the practitioner will our product be lessened in va the student.

With this view it is impossible to feel that the modern en pedic text-book is the proper work to place in students' hand is interesting and valuable to the practitioner, but it lacks sy and without system all teaching is a failure. It is true, one cannot compass all that is important to teach in dentistry, bu mind can give a thorough description of methods; and if these brought success to the writer, they may equally prove of va the beginner, while, upon the other hand, the variety of meth

the encyclopedic form leads to confusion of mind. This difficulty is fully demonstrated in the present methods of teaching in our dental colleges. It is encyclopedic in character; one professor giving his ideas, and another, ovèrlapping in subjects, will give perhaps an opposite view. The practical teaching coming into the hands of the subordinates will there receive another change, the demonstrator having his ideas to inculcate. These antagonisms cannot possibly work for good in the minds of the students. Men go from our schools with a mass of contradictory ideas that require years of experience to reduce to a system. I can see no present remedy for this state of things.

The period of didactic teaching is fast drawing to a close, or at least the time is fast approaching when it will be limited as a method of imparting knowledge. It is possible that it may be used in the future as a means to instruct in principles, but it should not go beyond this. It must be evident that practical details can never be thoroughly taught in this manner. Therapeutics, as well as the other branches of the curriculum, must be taught directly to each student.

This measurably means a change in methods of teaching, as well as of teachers. The traditional custom of appointing professors engaged in practice to deliver a certain number of lectures per week has had its day of usefulness. Men must enter upon this work and leave practice behind. The present mode is detrimental to practice and teaching, neither being wholly satisfactory. The consummation of this is, of course, yet in the future, but it is coming, and when we shall have reached this educational status we will have arrived at my ideal of true education in dental colleges.

ORAL SURGERY.

BY DR. T. W. BROPHY, CHICAGO, ILL.

A text-book is of value to the teacher and pupil so far as it contains matter upon the subject of which it treats in accord with facts established by evidence beyond controversy. Inasmuch as the rapid advancement in the scientific world in which surgical anatomy, pathology, and therapeutics, as well as operative procedure, hold an important place, the text-book on the subject of the oral cavity

and parts associated therewith must necessarily be frequent
vised or it will be misleading to the pupil, as it will fix theo
his mind which, in the light of more recent investigations, hav
set aside. Text-books cannot be dispensed with wholly, and
believe many of them are of little use.

Authors of text-books not infrequently write too much.
pad their books to such an extent that the whole volume
interest, as the really meritorious features are lost in the grea
of matter presented. The late Professor Garretson was th
qualified man our country ever produced to write a text-bo
oral surgery, but, like many other authors, he made a mist
not confining himself to the field of his own investigation
practice.

It is impossible for any man to present to our profession
book based, even in part, upon opinions not his own or upon
ject with which he is not intimately acquainted, and make
book popular and valuable to teacher and pupil.

A text-book should present the essentials of the subjec
which it treats; the teacher may elaborate.

A text-book should deal with principles, not with a recita
innumerable cases in practice.

It is not from the text-book that the pupil gets his most v
and impressive lessons; it is from his teacher.

The text-book never will be written that can make the pr
and indelible impression upon the student's mind equal to tha
by the strong personality of a Gross, Pancoast, Agnew, Gar
or Senn. It is idle, indeed, to compare the magnetic words
men and the lessons they have taught to the thoughts conve
ink and paper. What the average student of medicine, as
dentistry, requires to equip himself to practice oral surgery
so much a text-book on the subject as a more thorough kno
of the underlying principles of surgical practice. Are the s
of dentistry to-day well trained in anatomy? Do they do th
in the pathological laboratory thoroughly? Are they trained
technique essential to the construction of apparatus with w
successfully treat fractures and other injuries of the ma
bones? Fractures of the inferior maxilla are treated by
surgeons less skillfully and with poorer results generally th
other fractures to which mankind is subject.

The tendency to-day in all departments of school and college work is to use the laboratory and teach object lessons. So in oral surgery the student must, instead of depending on a text-book, *not only* know descriptive anatomy, but he must know surgical anatomy as well; and the course in the minutia of surgical anatomy of the oral cavity cannot be quickly or easily completed. As an example, the study of the anatomy of the temporo-maxillary articulation is very important to every dental student, and more especially so to those who aim to engage in oral surgery. The text-books cannot impart an accurate knowledge of this most active joint.

Practical study on the cadaver, not only from the standpoint of descriptive anatomy, but of surgical anatomy, and the relation of the important tissues to the articulation, must be fully comprehended if the young man would venture to operate in this region.

Even with all the knowledge obtainable from text-books and from his work on the cadaver, he will sometimes in performing operations find anomalies without precedent, and in the management of which his ingenuity and resources will be taxed to the utmost.

Are the students of our dental colleges qualified to pass well in the department of anatomy? Do they all carefully dissect the tissues, especially of the oral cavity and its associated parts, so as to be thoroughly acquainted with it? Do they dissect out the muscles forming the soft palate, together with the muscles which have relation thereto, that they may know its function and its defects; how, when, and by what procedure, whether surgical or mechanical, these defects may best be overcome?

A text-book is like a guide board at a country cross-road. It points the way, but it does not lead. The traveler may learn from it which way to go to reach the place he seeks, but the board does not inform him of the many curves in the road, of the hills he must climb, of the obstructions along its course, and other difficulties with which he must contend in reaching his destination. He must learn these things by his own hard-earned experience. Whoever would learn to be an oral surgeon must not rely to any great extent upon text-books, but upon work, persistent work; not wholly what he sees others do, but upon what he does himself.

Nor is it work alone that brings success. It is to a great extent the ability of the man to meet emergencies and do things not mentioned in the text-books, nor by his professors, but to meet condi-

tions which arise the like of which he never before heard. In words, he must be a man not only able to command and utili methods he has been taught, but devise and use methods of his

In the expressions of the noble Garretson, the father of Am oral surgery, under the shadow of whose name and influenc subject must ever be considered and taught, if you would succ the practice of oral surgery lay your foundation in anatomy. this place many courses in physiology. Then build the super ture in pathology; fasten and bind all together with the cem principles, and a mansion thus constructed will shelter and p you throughout your professional career. Without such fo tion principles you build only upon shifting sand.

DISCUSSION.

The PRESIDENT. I am very certain that we all feel we hav enough given us in this feast to occupy our time for the rest day, but we have only half an hour that we can give to the d sion of the papers which have been read, and I will ask Dr. to open the discussion.

Dr. G. E. HUNT. This session has been one of the most able of the meeting to me. The subject of text-books is an esting one. In my opinion, we need a text-book on therap more than anything else at the present time, although it n because I teach therapeutics that I think that. I wrote out comments on Dr. Arnold's paper which I will take pleasure ir ing, and to which I hope you will have pleasure in listening.

I confess I am inclined to favor to a degree the recitation use a forgotten phrase, for which I thank Dr. Webster, the S method. It may be argued that we are teaching men, not ch That is true, but yet the teacher who tries to instill inductive r ing powers into his class of *men* by the lecture system alo find that he has failed more often than he succeeds. Resu what we want. In my opinion more results will be obtai elucidating a point by questions than by a lecture alone. I not advocate the use of a single text-book in all studies. In ar I see no reason why Gray or Morris should not be adopt adhered to. In physiology Flint answers all practical purpo the assignment of a lesson. In dental anatomy I use Br But in no other branch, so far as my recollection extends

time, do I believe that we have text-books sufficiently comprehensive to use without more or less elaboration. In pathology I use Barrett, in connection with the Socratic method; and, at times, supplement these with a short lecture. In operative and prosthetic dentistry, crown- and bridge-work, orthodontia,—in fact all those branches pertaining to the art of dentistry,—we have no adequate text-books nor ever will. Any text-book on these subjects must necessarily reflect the views and beliefs of the writer, must be biased by his individuality. That is not true of the scientific subjects. Dental anatomy is dental anatomy, and whether the text-book be written by Black or White or Green or Brown makes no difference so long as the writer states the facts, and the order of presentation are the only points to consider in selecting such a text-book. But outlining a method of treatment for a putrescent pulp immediately introduced the personal element into the question. We do not then have a known *fact* presented by Broomell, Black, Morris, or Gray, but we have the method which has proven most successful in the hands of John Doe or Richard Roe offered for our consideration,—a very different matter. So that in these studies of the art of dentistry the lecture system, supplemented by the recitation system, is the most efficient method. In the scientific branches where a reasonably perfect text-book is available, I believe the recitation system will produce the better results. We have no text-book in many of the scientific branches that fulfills the requirement. If we had, I would be in favor of extending the recitation system farther than it is possible now to do. The advantages of the recitation system have been elaborated by the essayist, and it is unnecessary for me to repeat them. But before closing let me sum up my statements, that no one will misunderstand me.

1. By the "recitation system" I mean a method of teaching in which the student takes an active part.

2. I believe the recitation system is perfectly practicable and superior to any other method, in teaching the scientific branches of the curriculum, if we have the proper text-book for its presentation.

3. I believe that in some of the scientific branches we have no adequate text-book.

4. I believe that in those branches pertaining to the art of dentistry, it is only applicable to a degree, and must be supplemented by more or less elaboration on the part of the professor.

Dr. W. C. BARRETT. Dr. Hunt knocked me out by the reso he offered the other day. I can never find the end of a string minutes. I never want to make my first speech in the secon Some of us remember what Dr. Thompson used to say,—th one who used a text-book was unworthy of the name of teach do not quite agree with that, yet I think we use text-books too in our practice. If we use text-books at all it must reflect th sonality of the man who teaches. The teacher who tries to and does not impress his personality upon the students is not fi teacher. He may teach wrong; better do that than not teach You take exception to that. I mean within certain limits. I mean to teach falsehood, but that he should teach principles better than not at all. He must impress his individuality up students. The text-book is useful as a statement of prin truths, axioms, which are perfectly arbitrary in their cha You learn the multiplication table from the text-book, but you learn how to use it in your business. In anatomy a text-b absolutely essential, because you must learn a description bones; but without the bones themselves a text-book may e mislead you, and you can have no conception of their form any than sight can give an idea of harmony. A text-book, th limited in its application; exceedingly limited, especially in n that depend upon experience and observation. In many ca text-book is a delusion and a snare. Hence, in my opinion, n will ever take the place of lectures. Nothing can take the p elucidation of principles by the teacher himself. The pri which it enunciates are not applicable here, and must be qu there. There are so many accidental incidents which ente the problems, and must be considered in proper relations text-book can consider but one at a time, and so I say the tex at times is a delusion and snare. In treatment of alveolar a or any other pathological condition we can conceive, the tex lays down certain rules. It says a counter-irritant should b but there are so many. It may be that tincture of iodin r indicated for treatment, but there may be other features p which absolutely countermand the use of it, and you must use thing else. Hence the text-book which cannot explain the c stances, which cannot teach students to sum together the di features, add them up and group together all the sympton

from the sum of the whole arrive at a conclusion as to what is proper,—I say if it does not do that it cannot teach properly; and the text-book cannot do that. Hence I feel quite antagonistic to the idea which is being urged at the present time, that we should make greater use of the text-books, and that we should eliminate the lecture system and substitute text-books and recitations. I think the idea is all wrong. It is perfectly useful in teaching mathematics and anatomy, but will not answer for pathology and therapeutics.

Dr. H. A. Smith. There is just one point in Dr. Truman's paper I want to call attention to. I understood him to say the better teacher was not necessarily a practitioner. It seems to me the man who is in touch with dentistry as a practitioner is the only proper teacher. At the same time, the teacher too often comes before the class a used-up man, having worked in his office all day. He should give his best services to the class, and that would be after a night's rest, before he goes to his office at all. Professor Abbott told me once he practiced dentistry all day until half-past four, then walked to the college and lectured from half-past four for perhaps an hour. With all his vigor, with all his determination, he was not doing his class justice, was he? If he had gone to the college in the morning and then to his practice, he would have done his class more justice, but then he would not have done justice to his patients. I believe a man who lectures should take a rest between lecturing and office practice. Formerly we had a lot of professors who came when they pleased, and they were not good teachers for that reason, teaching after working all day. We try to pay them now, and have them in the morning, while they are at their best.

In the treatment of pyorrhea alveolaris which was referred to. If there is anything in God's earth the treatment of which is confusing, it is the directions given for the treatment of that; nobody but an experienced practitioner can teach such treatment, and so of many other disorders. So I say only a practitioner is a fit person to teach even anatomy, or any other subject in the curriculum.

Dr. A. E. Webster. Judging from the remarks and the papers, it would seem to resolve itself to this, that it is mental training we want. You don't need to go into detail with a man who has a cultivated intellect. In giving instruction in infirmary practice, never tell a student what you think until he makes a statement for

himself. If you do that you have given him a training, and what he needs. It is a question of judgment, and if we can our training so as to cultivate the judgment of the student, n that the idea from the very first day, and so on until the s goes away, we should have no trouble. The student should a such mental training that he can determine these things for hi

Dr. G. H. WILSON. There is one thought I would like to of in connection with this matter of teaching, and it is an arg against Dr. Arnold's position; and it seems to me a stron It is this, that we express our ideas by words. Some one mu the words. The great object of class teaching is to have th instructed, not one individual. Now, who can express th better, the student who is to be instructed or the professo you say the student, then you must say he should be the teach

Dr. WEBSTER. I want to say the student is the teacher. T the point. Make him the teacher. That is just where I diffe the essayist.

The CHAIRMAN. In what sense is he a teacher?

Dr. WEBSTER. You arouse him to action. You must interest. Interest is not a mental act. It is impulse. You arouse impulse of the mind first, and then after interest comes tion. You cannot make yourself give interest. Now, then, question of ideas of one student from the other, and the t back and forth. Have interest, and then you will get atte Without attention you do absolutely nothing.

Dr. W. C. BARRETT. The teacher is the one who first su the idea?

Dr. WEBSTER. I didn't intend to go into that at all, but it this way. You must first put an idea in that student's mind you can put anything else round about it. The idea is on veloped by the student acting on it. He builds around the id

Dr. BARRETT. Where does he get the initiative?

Dr. WEBSTER. He must have that from perception. It is himself. He needs development. We go back to the sensat touch for all things. That, I know, is contrary to all present

Dr. G. H. WILSON. I think I used the wrong word when "teacher." I should have said "professor," or the one who impart or stimulate the acquirement of knowledge. If we e a teacher or professor and pay him a large salary, we shall

satisfied for him to take a text-book and assign lessons and hear recitations. An assistant of limited resource can do that. But when we pay a man a high price to teach we want one who can bring in all things and give instruction, and not spend time in hearing recitations. He will ask questions, most decidedly.

Dr. W. E. Grant. I wish to say that assistants are of no account at all. They are absolutely of no account. Dr. Webster struck the keynote when he said we must arouse the interest of the student. Ask them questions, and make them answer; and at subsequent lectures question them as to the preceding one. Half of a man's time at least ought to be given to hearing from the students themselves, to see if they have received what he has given them. In that sense the students are the instructors.

Dr. Barrett. That is all very well, but here comes in another point. It depends somewhat on how deep a man's *pond is*. If a man's pump begins to suck air at the end of fifteen minutes, he has got to begin to ask questions. If he is the teacher he ought to be, if he knows his subject thoroughly, he cannot afford to stop to question as a general rule. He should have some one to do his quizzing; not that he can do it as well as the teacher, but because he can give more time to such an exercise. You have an assistant in the laboratory to do the coarse work for you; not but that you could do it better, but you cannot afford to do it, and so with a good teacher.

Dr. G. E. Hunt. I think we are all agreed there should be a combination of the lecture and recitation system. You can bring a point out better by questioning a student on it than by stating it to him.

Dr. H. W. Morgan. I had not intended to speak. I think the trip to Philadelphia has been worth the treat we have had this morning in these essays on text-books, but I cannot understand the trend of the argument here for the class-room system when each and every one of these essayists have agreed that we have no text-books. We must get text-books first, and then we can go to the class-room. That is the first requisite. I am satisfied that these essays will do good. They will be read by the book-makers in the future before they put their books on the market.

I am agreed with the gentlemen who have spoken as to the blending of the two methods. It is a very bright man indeed who can

elicit it from a student's head who does not first have it in his
I believe that the teacher must have enthusiasm. Enthusia
that which indicates the degree of authority, because there is a
more or less question when we read an article, especially wh
work comes from a teacher made along the line suggested b
Truman in his article, men who are not practical men; me
are not in active practice; men who have been doing this thin
after year, and especially along the line of anatomy they hav
doing what? Copying errors, as we have learned by Dr. C
work in the last five or ten years. We are to have a revo
through men like that, who go to nature for their facts. We
work on those lines. It is only the worker who can prepare
and do the teaching.

Dr. J. Taft. This subject is undoubtedly of very great in
to us all, and it shows that there is a recognition of the fac
improvement can be made in our methods of teaching. And
glad to see so much interest, because where there is this in
and this feeling about it, looking about for better methods
will likely be found. If we should rest content with the m
of teaching of former days, the profession would be in a sad
tion. We are dependent for progress in these last years o
very question of inquiry.

As to text-books and other means of instruction, books ar
because they contain in their pages the experience of the w
If the thoughts that are presented here to-day should be pla
paper, would they be any the less valuable? Certainl
Thought which is placed on the page is just as valuable as t
it were spoken, essentially, with this exception, that by the s
words the personality of the speaker makes an additional in
sion that cannot be made by the written or printed page.
while I believe principles should be presented in the form
tures, the comprehension of many students can be aided very
by reading, by illustrations of models and drawings; anythin
everything of this kind that can be made serviceable in impr
and drawing out from the student his best thoughts. These
valuable.

Now as to recitation methods. You have a book here use
after year. Did you ever deliver two series of lectures
alike? Have you not been gaining all the time more know

If not, you had better quit teaching. We are learning constantly, and the teacher who does not seek to give to his students the benefit of this growth is falling far short of the thorough teacher. A good teacher will find new material all the while which will be valuable in his work with the students. That places the text-book and the recitation method at a disadvantage. If you follow a text-book two or three years old and bring into it what you have since gained, you remove the greatest objection to the recitation method. My impression is there is no method so good, and that will reach the aspiring, industrious, enthusiastic student as the lecture method. You are constantly adding your accumulating knowledge and giving the student the benefit of it.

I can hardly see the propriety of the method suggested by one of the speakers, that a teacher must stand merely as a pump, and draw out from the student what may be in him. The value of your teaching depends on your own knowledge. Have you no more than the student? If not, where is your superiority? If he has as much as you, how can you help him? If Dr. Webster has the power merely by his presence of communicating knowledge to his students that he possesses himself, it is a wonderful thing. You cannot draw from a student that which he has never had or conceived, and has not a basis upon which to form a conception of the knowledge you wish to give him. I do not think Dr. Webster means to lead astray, but he advocates an impracticable theory which he seems inclined to push to the extreme.

There is one feature that has been left out altogether. Here is a very bright student, comprehending everything you give him at once, ready to take a text-book and make a recitation on it; another student is so dull you have to cram it into him. There is a very great diversity in the ability of students to comprehend what is given them. Men who have been accustomed to mental work will catch the ideas much quicker than one without this training. A bright student is a stimulus and inspiration. How different is the feeling when you see another student half asleep. Somebody said this morning that the students laid down in their seats and went to sleep, and when you wake them up to ask them a question they turn over again and go to sleep. The question is, what shall we do? Some one has said get down to the comprehension of the dullest student you have and work on him. What are the rest

doing? This is a problem I have not been able to see th If we could select for our students all bright, educated, cu students, whose minds take in and comprehend at once w given to them, what a glorious thing it would be to be a te But how discouraging it is to take the dull, listless, careless s and endeavor to get it into him by some means or other. frequently after repetition you see he does not understand you turn it over and present it another way; and finally y something into him, but it is exceedingly discouraging.

Dr. WILSON. Do you think it is possible to ask questior dull student and draw the knowledge out of him?

Dr. TAFT. I don't think so. If you can't get anything int how can you draw it out?

Dr. F. D. WEISSE. I am sorry I was not here earlier. delighted with the remarks of Drs. Taft and Morgan. As I stand it, it is the question as to teaching by recitation from learned in the text-book. That is one phase of it. It is r pression and the impression of those with whom I have c contact that the personality of the lecturer carries great As Dr. Taft said, the lecturer combines in the lecture a gre of work outside of the lecture. The lecturer combines the thought and digestion of many text-books, and the student confined to one trend of thought, but the lecturer gives him census of opinion from many authors. I think if student examined more by the professors it would be much better. our method to have weekly examinations, in which the pr meets the class and examines them. He passes around si seventy questions. I can pass around probably sixty in ar requiring short answers. Frequently I have the first and year men together, and if one cannot answer it, the other c the second year man cannot answer a question and it is an by a first year man, that is a triumph for the first year men, interest is kept alive. In that way the student is kept in with the professor by the questions he asks.

As to text-books, I tell the students in the first lecture use the text-book. They work too little with the indexes c text-books. If you want to work to advantage to get at a s turn to the index and find out the page on which that subject found. Find the answer to the question, and when you hav

it shut the book. Don't allow the eyes to run beyond that. In that way text-books are valuable.

The CHAIRMAN. It has been quite difficult for me to restrain myself as your presiding officer. I have found it almost impossible to keep still on this subject, because it is one of exceeding interest to me. I know there are others who feel as I do, but our time is limited and we must close the discussion, as the time for adjournment has nearly arrived. I will ask Dr. Arnold to close the discussion, with Drs. Thompson and Brophy to follow him.

Dr. ARNOLD. In writing on text-books, I assumed they were in general use and that they were written for a purpose. I have discovered here that writers of text-books have condemned them. I don't know why Dr. Barrett writes a text-book when he don't expect us to use it.

Dr. BARRETT. I quoted another, not myself.

Dr. ARNOLD. I tried to arrive as near as possible at some plan as to how to use text-books, taking for granted that they were of some value. We must have a foundation to start on. The question came up in discussion as to where a pupil first gets information. He is asked to recite; expected to be a teacher in a certain sense to the rest of the class. I believe with a starting point he might be a teacher to some extent on what he recites, but he must get the foundation from somewhere; therefore I don't see how we can well dispense with text-books. With all their defects we love them still.

The question of bias was mentioned. Is the writer of a text-book any more subject to bias than a professor? Not at all. I think the lecturer may be just as biased in his scientific attainments, and as dogmatic as the writer of a text-book, so I see no especial reason why exception should be taken on that ground. The teacher illustrates and corrects the mistakes that may be in a text-book. Where is the perfect text-book? I don't believe there are any; there is constant necessity for revision. I believe the dental profession uses text-books less than any other profession. I don't see why. We claim to be a learned profession, yet use fewer books than any other profession. I don't think that is quite to our credit. I advocated the combination of oral teaching with the systematic use of the text-book.

Dr. A. H. THOMPSON. The trend of the discussion has not been very desirable. The indication, however, is favorable, in that the

desire seems to be toward simplification and coming back to natural methods. We know we must deal often with students who have not ability to understand and comprehend a lecture, and they cannot get it out of the old-fashioned heavy text-books. I think the tendency is very satisfactory, in that there is a desire to simplify and come back to the first principles of scientific methods of instruction.

Dr. BROPHY said he had nothing especially to offer, but thought much more attention should be paid to laboratory methods than either class-room exercises or lectures.

The CHAIRMAN announced the discussion closed, and the next order of business to be that of installing the newly-elected officers.

Dr. Hunt conducted the newly-elected president, Dr. H. P. Carlton, to the chair, and in greeting him Dr. Hoff, the retiring president, said,—

It gives me a great deal of pleasure to deliver into your care and keeping this organization for the coming year. Young as it is, it demands great care in the guidance of its affairs. Although it is young, it is vigorous, and will need skillful direction for the future. I trust you may do more for it than I have been able to do this year. I feel proud to point to this meeting as a result of the labors of myself and *confrères*, and I commend this organization to you for your best thought and care the ensuing year, for what you shall do may mean much to the progress of dental education in this country. You have men to work with who will enthusiastically respond to every call you may make of them, and I commit them to you for your thoughtful care and consideration. Gentlemen, I present to you your new president, Dr. H. P. Carlton, of San Francisco, California. (Applause.)

Dr. CARLTON responded: I thank you indeed for the honor and the confidence you have shown me in placing me at the head of the Institute of Dental Pedagogics. It rests entirely with me now to prove whether your confidence has or has not been misplaced. I believe you will find at the close of the next meeting that it has not. I feel very grateful for two things: First, the example set me by our retiring officer, Dr. Hoff. His course I shall endeavor to imitate. I have for assistants and advisers a most admirable board of executive officers, of which Dr. Morgan will be chairman. No extended address is expected of me now; I shall inflict that upon

you at the opening of the next session. I am very proud of the fact that you have elected me presiding officer, and I shall try to prove myself worthy. Gentlemen, I thank you. (Applause.)

The vice-president, Dr. G. E. Hunt, was then presented to the society.

Dr. Hunt thought no speech was required from him other than an expression of thanks for the honor conferred.

The secretary and treasurer, Dr. Goslee, was then introduced, and said: I shall not indulge in any remarks, except to say that I am thoroughly appreciative of the courtesy extended to me in my re-election. I deem it an honor indeed, and shall endeavor to attend to the duties of the position to the very best of my ability.

The meeting then adjourned.

PROCEEDINGS

OF THE

Eighth Annual Meeting

OF THE

Institute of Dental Pedagogics

HELD AT

Nashville, Tennessee
December Twenty-seven, Twenty-eight
and Twenty-nine, Nineteen
Hundred

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Proceedings

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EIGHTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics,

HELD AT

NASHVILLE, TENNESSEE,

December 27, 28, 29,

1900.

PREFATORY NOTICE.

The Publication Committee presents this report of the eighth annual meeting without comment or apology, believing that the results tell their own story.

GEORGE EDWIN HUNT,
HART J. GOSLEE,
DAVID M. CATTELL.

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Proceedings of the Eighth Annual Meeting of the Institute of Dental Pedagogics.

ADDRESS OF WELCOME.

By Dr. D. R. Stubblefield, Nashville, Tenn.

It affords me a great deal of pleasure to offer some words of welcome to you. In fact, the idea brings me a good deal of satisfaction. But the necessity of attempting to execute it at a moment's notice all but overcomes me. Nashville has been fortunate in many other respects, but this is the first time that her good fortune includes that which we have to-day—the presence of so many dentists who are not only dentists, but are also teachers—men who represent a live and progressive profession, and are the practical exponents of it; men who are engaged in the practical work of making the finished product. I congratulate Nashville, therefore, on having the opportunity of indulging in the deliberations of this body, that is so unique in the world of our profession. We flatter ourselves that whether we are worthy or not, it will be an occasion rich with experiences and bring to us a satisfaction in the way of return that will stay with us.

We hope that your deliberations here will be at least not disappointing. We wish that our facilities were greater and better than even the mark and execution of our desires, but the best we have we give to you; all we have we cheerfully put at your disposal, and I wish to say, as the mouthpiece of my profession in this city, that I declare to you that you are welcome. Now, if you doubt it, put it to the test; ask, and you shall receive just as much as we have to give, and what we cannot give, we wish we had in order to give. So, I say, that in congratulating ourselves upon

this happy occasion, we give everything we have to you, and we hope that you will enjoy your stay and profit by it, as much as I am sure we will both enjoy and profit by your coming.

DISCUSSION.

THE PRESIDENT: Gentlemen, on behalf of the Institute of Dental Pedagogics, I will ask Dr. Brophy to respond to the welcome of Dr. Stubblefield.

DR. T. W. BROPHY, of Chicago: It would be impossible for me to express the embarrassment of my position better than to make use of the remarks made by Dr. Stubblefield when he first took the floor. It was intended that another member here should respond to this most cordial welcome, but he has declined, and the president has forced me into this position against my will. Not that I do not value the opportunity to express our appreciation of the most cordial invitation extended to come here, and the cordial welcome upon the part of the gentleman who has just taken his seat, but because I always shrink from responsibilities of this kind.

It is gratifying to feel that this body has grown to be so important in the work of education, and it is a great pleasure to us all to come to the city of Nashville to bask for a while under this delightful Southern sun, to meet the warm reception and cordial greetings of our friends, and to enjoy the Southern hospitality, which is proverbial the world over.

We thank you, Dr. Stubblefield, for this cordial welcome.

PRESIDENT'S ADDRESS.

By Harry P. Carlton, D. D. S., San Francisco, Cal.

It is with great satisfaction and no little pride that the first meeting for organization, held during the World's Columbian Dental Congress, in Chicago, in '93, is recalled. As we look out upon the *results* of that gathering, in this meeting here in Nashville, these few years later, we realize that we have developed and expanded most comfortably for seven years under the title of the "National School of Dental Technics," but this is our first year as the "Institute of Dental Pedagogics," the title adopted at our last meeting to indicate our desire for a broader scope, a larger usefulness and farther reaching results.

That our last meeting was certainly one of great interest and fruitfulness need not be said; our carefully edited transactions testify to that. While deeply impressed with every paper then presented and so ably discussed, the symposium of the fifteen-minute talks on our text-books seems to me to make the most lasting impression, and I would recommend something along similar lines to every succeeding program committee. So much in retrospect; in prospect we are this year to have the banner meeting of our existence as a Society, for the program has been in the hands of a most efficient committee, and we are meeting among the most hospitable and warmest-hearted people in the world. What with program and entertainment in the hands of Henry W. Morgan as Chairman, there will be without question a great "feast of reason and flow of soul."

In glancing over the programs of our last few sessions, I have been impressed particularly by the papers on methods in teaching. Dr. Wright's excellent paper, two sessions ago, on "The Problem of Methods," will be remembered; also the late Dr. H. H. Burchard's on "Teachings of Pathology and Therapeutics," and the able article of Dr. Webster at the *last* meeting, on "Dental Pedagogy," which he considered from the standpoint of psychology, and which evoked a most profitable discussion. Great though the bene-

fits gathered from all these by the attentive teacher, it seems to me that in his opening address of last year, Dr. Hoff struck the true keynote in speaking of the teacher himself, when he asked, "Does it necessarily follow that because a man has made a success in the practice of his profession he is qualified to administer the affairs of an institution to educate professional men, or because he can make a beautiful and artistic filling that he is the man to instruct others in the same art? And are not many of our teaching faculties organized on these standards?" In full accord with this is Dr. Kirk's weighty declaration, "What dentistry needs to-day more than anything else is properly trained and educated teachers."

Accordingly, I owe it to the richness in suggestion of the address of my predecessor that I have a theme for an opening address to-day. I can throw the weight of my opinion in with his by considering, not "What shall we teach our dental students? When shall we teach it? How long shall the course of teaching be?" but "What constitutes the well-equipped teacher of dentistry?"

The subject impressed itself on me at our last session and this arrangement of my thoughts and your discussion thereof, I trust, will prove a means of weighing and measuring of values. To a good many of you veteran teachers this is ancient straw. But for the sake of the younger generation will you kindly turn it over and thrash it once again? Agreeing with our past president once more, I think the floor of this institution the proper place for such discussion.

This properly equipped instructor, like the true poet or musician, surely is not *made;* he must be born. Truly, some of us indeed are "teachers by accident," but most of us are engaged in the work because we like it. With some, again, heredity may play its part. My own father, especially fitted for his life work, spent nearly forty years instructing along *normal* lines, so I think it would be safe to say that *some* of *my* desires at least came not entirely by accident.

It has been said that the best way to educate a man is to set him to work; the way to get him to work is to interest him; the way to interest him is to so vitalize his task that he will love it. These are the foundations upon which the perfect teacher builds. Far more important than the question, What shall we study and how long? is the question, *Who* shall be our teacher? How must Nature have endowed this man, this teacher? *First,* with the gift to arouse

within the student-breast an interest so full that its expansion becomes a *love* for his life-chosen profession. With a mental equipment, and possessing a power to *transmit* this mentality; for real teaching is causing another to know. As Dr. C. O. Kimball so beautifully expressed it in a recent paper, "to pass the torch," transmitting to others his fund of learning, observation, experience and skill, talents entrusted to him by no *accident*, but of purpose." So he causes his pupil to *know* as *he knows*, and his intelligence to be awakened and keen, and, having interested and instructed him, to lead the student into making actual application of all practical problems. Briefly summed up, then, our ideal teacher must succeed in causing his pupil to love his work, to know it and to use it. Anything that you or I can do, that will accomplish this thing, is good teaching, and constitutes a good teacher.

The paramount issue with us, then, in the college campaign (and four years is little enough time to cover the ground), is to create an interest, a motive, a purpose—the rest will surely follow. Your new student is first to be imbued with the idea that he comes to the college for the help he can get from the *study*, rather than for the sake of the graduation and the degree, and then every man will be assured that he has made no mistake in commencing the study of dentistry. Be his guide along the paths that traverse the forests of knowledge, gathering general truths, the fundamental points you desire to leave with him. If there be a listlessness to overcome, drop into homely and old expression, that gives the mind a nudge and leaves an impression—that is like turning a corner suddenly and seeing something entirely different from the expected. He will now lend a willing ear, and your instruction will prove effective—for after all it isn't so much what you *teach* him that counts, as what you enable him to think for himself. *Give* him something to think about—something to occupy his attention while you are impressing your vital truths. You may have heard the story of the old blacksmith, who tried time and again to shoe a most unruly mule (a mule unusually endowed), and he generally was kicked out of his shop before finishing the work. The smithy studied long upon some plan for success. Finally one day he tied a little piece of string around Mr. Mule's right ear—not too tight, he said, but tight enough to give him something to think about; and he gained his point.

Oftentimes there will be no power in the book or even in the subject to overcome the apathy; then the power of the man, his

personality, should score. Do not mistake me and think I believe that *individuality* should come to the front. The curb must be kept on *that,* lest it be overdone. We are apt to become *too* enthusiastic, feeling our success, on noting the impression being made; to enjoy it too far and become vain, and indulge in it for our own pleasure.

I once heard a dental teacher say, "I like to lecture to those Freshmen immensely; they are so new, they drink in every word you say, and anything goes; but I am afraid of the Seniors, they know it all." This type of teacher, is not in earnest, his well is shallow, and, as Dr. Barrett so aptly said last year, "his pump will soon suck air and he will have to quiz." The earnestness that aims at great success never fails; once let it enter and everything mean and unworthy is excluded; all follies give way before it; all indolence, apathy, antagonism, give place to earnest endeavor.

The instructor who has earnestness in himself, not a false and simulated thing, like a flitting phosphorescent glow of marsh gas, but the *real thing,* that gives a steady flame with warmth, as well as light, communicates his light and heat to those so fortunate as to sit before him. The eminently successful man is an *enthusiast,* whatever his occupation, especially the man who aims to interest other men and prompt them to make their best efforts.

Men follow a leader who inspires confidence by believing in himself, and the "world stands aside to let *him* pass who knows whither he is going." True, this self-confidence may rest on small and uncertain attainments, and yet it is a "motive force," and as such produces motion, and motion is necessary if we are to "get there." No cold and hesitating instructor may hope to inspire that all-absorbing passion for knowledge that sometimes dominates men's minds and makes them devote time and talents and life itself to the pursuit of science or perfection of art. The American teacher is supposed to know something about *everything,* and as much as he can learn about *something.* There are many who consider such knowledge as a complete equipment for the work he has to do, but it is *not.* If he has not *enthusiasm* he will be as dry as the dust in his own lecture room. Not infrequently the young man who works out to-day what he must teach to-morrow is far more successful than the veteran whose familiarity with the subject makes him forget the difficulties he had to surmount, the problems *he* has mastered. I would not convey the impression that I favor superficial attainments, for I do not; but earnestness with even *moderate*

attainment is more effective than a perfunctory performance by the most *erudite.* Enthusiasm is contagious; it gives a ring to the voice, a flash to the eye, a flush to the cheek, an incisiveness to the speech. If we know what we are talking about, and know it well, and talk about it as if it were of vital importance, we may fling all the theories of the pedagogues to the four winds, for we will create a desire for the fullness of knowledge that will not rest satisfied with anything else. To the student thus vitally interested, the acquirement of knowledge will become pleasureable rather than painful; its presentation to his unfolding mind creates a healthy appetite to which you and I must cater, not with indigestible material, but with facts ready for his digestion and assimilation.

We have heard a great deal said of methods and methods. We *all* believe in method, but *freedom* of method with originality. An eminent educator recently said, "*Text-books* really hold the great majority of our teachers down to a well-defined routine." To all practical purposes we dental instructors are doing the same things, teaching the same material in very much the same way. But teaching and *depending* upon *another's* methods is very much like "wearing the other fellow's coat." There must be the *man* along with the method.

They tell a story of a professor in some Eastern college who was a splendid instructor in mathematics. In a foolish moment he was persuaded to write a text-book on his subject. He wrote exhaustively, but it was a complete failure, because he could not put *himself* between the covers of the book. Good text-books, that have stood the strain of criticism, text-books constructed out of the experience of better teachers, are a guide to us in the arrangement and logical sequence of the main division of our subject. So far, at least, should they be at our hand to keep us in line. There is absolutely no way, to my notion, that a teacher can keep *en rapport* with his class except through the medium of a good text-book. But this narrowing a class of young people down to *a* text-book—this shackling of their minds to it—is very bad. Beware of "domination of authority"; the teacher by the text-book author, and the class by *his* authority. Some of us are apt to indulge in this method of instruction, thus limiting the expansion of the student's mind. This ironclad system of pedagogy, as now served up in the majority of our public schools, doesn't appeal to me. Your child and mine, and everybody else's, are stirred up together, and made into a paste and

pressed into shape, like so many bricks—molded just so, exactly alike. They do their examples, write their Spencerian copy, precisely alike. It is not until the pupil gets away from this sort of sore-back, method-ridden system, so much in vogue to-day, into the broader atmosphere, let us say, of the University, that he really commences to think for himself. On the contrary (and equally unsafe), there is such a thing as cutting away all restraint; knocking out all the blocks, and floating away on a current of our own choosing. We, then, in our line of instruction must establish the practice of "appealing to their *reason* until they have gained the right to private judgment."

Methods have their place, but "the fire will not burn with all the laws of science or combustion at your command, if you lack the material with which to lay the fire ready to burn."

Some of you may remember the inspiration there was in the old-time winter school, conducted by some young college student for the purpose of paying his own way. *He* had no theories—very little of practice or of other men's methods; his text-books were few and ill-advised. But what of it? He had what was better than courses in pedagogics, better than libraries, better than text-books, however good—he had a tremendous earnestness in himself, that brooked no opposition, and it begat a like earnestness in the boys who trudged through the snow to sit and learn. I have heard men refer to the "superficial training" that boys received in those days, but when I think of the thousands of our greatest men who had nothing better than the winter school, and oftentimes little of that, I am persuaded that all the value does not lie in pedagogical theories and practice, text-books and fads. Contrast, then, the old with the new, and let not the new cast out *all* the old; for all good things are ours; all good methods and means and the thoughts that have come out of honest minds, are ours to adopt, and we should build them in. "We must know the paths our predecessors have trodden if we would tread them farther."

The mechanical routine teacher is *satisfied* with his work and himself. His whole business resolves itself into that of a pump—simply to be pumped full from some reservoir, that he may fill all the little pitchers held up to his nose. In contrast, a perennial spring, constantly bubbling forth, a center of supply—the one a task-master, the other an inspiration.

"No part of a man's education is of very much value to him unless

it is in *some way* concerned with his future growth," says Dr. David Starr Jordan, of Stanford University, and this is specially true in dental education. There is a strong tendency among students to devote their entire energies to the practical branches, seemingly ignoring anything and all that would promote the spirit of research; the result—a "bread and butter" course of study. Whether the attitude of mind that demands an immediate result and in the same breath wants to know what there is in it, is favorable to the advance of knowledge, or not, is a question; yet this is the attitude of the American mind to-day. When we have less of the "White Man's Burden" to bear, we will doubtless accomplish much more in deep research.

This desire to *go to work,* this indisposition to undertake deep study, has filled the country with "Cramery Schools"—institutions that offer to equip the student for an active professional career in a few months. They furnish facts without reason, solutions without proof, and turn them out upon the public what *they* call "practical men," to make blunders, to do harm, sometimes irreparable, and bring technical education into contempt among those who are not able to detect a fool masquerading in the garments of a student The one sure way to fight such institutions successfully is, having equipped the faculty with men of quality, to make instruction deep and as far as possible exhaustive.

Given our student filled with enthusiasm for his work, and having gained a mastery of its general truths (the final aim of all instruction), the teacher's task remains to enable him to turn all this to practical use, and it ought to be an easy and natural sequence. Herein lies the value of personal contact, those hand touches which make you friend and associate, instead of professor. We may talk forever from the platform, but it is the personal work that does the *real* good. Here we get the impress of knowledge upon knowledge, and are down among them, inspiring and invigorating.

Here is a new vision of what education means—not the pouring in of knowledge by the quart—opening the student to see how much has been poured in; but *seeing* him think, talk and *express his thoughts* by putting what knowledge he has absorbed to practical use. I will speak of methods only to say that it seems to me that we should teach *principles* to the *lower classes,* and then get in touch with the Seniors, aiding those who are struggling; perhaps failing, in a way perhaps, no demonstrator can do. With very large classes,

this is well nigh impossible, and the true lover of teaching deplores the unwieldy college classes, where large numbers prevent personal contact. But *that* personal contact exercises the greatest power when, in addition to these qualifications of enthusiasm, mental equipment and practical ability, there is added ***moral fiber.*** If there be behind the teacher the manly man, the individual of the purest moral fiber, you have what must ultimately be the greatest and most lasting success as an instructor.

DISCUSSION.

DR. H. B. TILESTON, of Louisville, Ky.: In being selected to take part in the discussion of this excellent paper of the president, it seems to me that either my age has been overestimated, in grouping me with such patriarchs as Dr. Taft and Dr. Barrett and Dr. Weise, or I may accept it as a compliment to my experience and ability as a teacher, which, in that case, I know has been overestimated. Or, perhaps, we were all chosen because it might have been surmised by the Executive Committee that a president's address would not likely be of such a character as to call for very active and up-to-date discussion. If that were the case, then an unfortunate mistake has been made, for this address of Dr. Carlton's deals with the most live and vital question that could possibly come before this Institute of Dental Pedagogics—*the question of the teacher himself.*

It is a fact—deplorable indeed, but nevertheless a fact—that there are many men now engaged in teaching in our dental schools who are utterly unfitted to the task which they have undertaken. But it must be remembered that we have no normal school where teachers may be trained in the line of thought and action necessary to take positions as professors in our colleges. It is true we have this Institute of Dental Pedagogics, but it is not adequate to the demands as a teacher of teachers, to teach. We meet once a year, and we have a session of two or three days, but we cannot expect to make teachers in that length of time. Nevertheless, this institution is an excellent aid to instructors, in the fact that we get inspiration and new ideas, and if we go home and put them into effect, there is no question but what this organization is of great value. And yet it is not equal to the task of making teachers. For these reasons it has been necessary, in the newer schools, especially, and in fact in the older schools as well, to put men into posi-

tions as teachers who have not had the special training necessary to make them successful. Occasionally these selections have been wise, and men have developed rapidly into positions of prominence. They are the men who probably are "born teachers," as Dr. Carlton expresses it.

Now there are some men who are born great, others acquire greatness, and still others have greatness thrust upon them. With those who are born teachers there is no difficulty; they take hold of the work and succeed in impressing their ideas upon the minds of the students without any trouble at all. Then there are those who have acquired the art of teaching—and I do not know but what they make the most valuable teachers, because they have gone over the rough road, they have hoed the ground over themselves, and they know just what it is; it has impressed itself upon them, and if they only have the ability after having acquired that knowledge, of transmitting it to others, then they make very valuable instructors. Then we have that class upon which the position of teacher has been thrust—and I believe that represents the largest number in the professional schools to-day. They are men who may have been selected because they happened to have been associated with those who originated the idea of the college, or maybe personal friends of the faculty, or some who have assumed positions of prominence as writers, or they have been selected sometimes to chairs in the line of their daily office practice, or, according to the necessity which existed, to fill anything which happened to be left unfilled. Hence our teachers are not always best fitted for their positions, but it is a matter that cannot be helped. The best teacher of teachers is experience, and it will take many years to equip all of our schools with men of the caliber and grade that we desire to have.

Those upon whom this distinction has been thrust are the ones the essayist refers to as "teachers by accident"—a great many of us, I think, are "teachers by accident."

The object of a lecture, Thomas Huxley says, is: First, to awaken the attention, and arouse the enthusiasm of the student, and this can probably best be done by the personal influence of the lecturer, who understands what he is talking about, and for that reason commands the respect of the student; and in the second place, the lecture serves to direct or guide the attention of the student to the salient points of the subject, and at the same time compelling him to consider the whole subject, without allowing him to follow

what personal taste he might have to take up some certain line of thought because it suits his fancy. But, after all, the lecture is but an accessory to that great instrument of scientific instruction, Demonstration.

The essayist has said if you want to educate a man put him to work; and if we attempt to teach a scientific subject by lectures alone, we will fail, because the limitation of language is such that we cannot possibly impress upon the mind of the student adequately, by means of words, a complicated operation like the preparation of a cavity and the filling of that cavity, from the platform. You cannot do it. In teaching so intricate a subject as dentistry there must be method regulated by system, and the system should be of such a character as to keep the lecturer and the demonstrator exactly in the same line; they should be in perfect harmony, and there is no better way, perhaps, of acquiring that, than to have a school among the demonstrators. That has been put into active use—has been the custom, I think, in the Northwestern School, under Dr. Black, and it has been put into use in our school to great advantage; meeting the demonstrators as a class, keeping them in strict accord with the lecturer, so that the demonstration will follow in perfect harmony; and there should be given nothing to the student in one department which is contradicated in another.

There is a difference between learning and knowledge. A student may take a text-book, and he can memorize that text-book if he has a retentive memory, from beginning to end, and he has learned it, and he may have such a retentive mind that he can listen to a lecture and almost repeat it afterward; he has learned it, and yet he has no knowledge of the subject.

The only way, in teaching scientific subjects, in my opinion, to give both the learning and the knowledge, is to demonstrate afterward what has been presented from the platform—either by the professor himself, if he has the time, or by the demonstrator, who, I suggested a moment ago, has been trained by the lecturer himself so as to be in perfect harmony with him and his teaching in the demonstration. A good plan is to divide the class into small sections of twelve or fifteen, and the professor can meet those sections in a room set aside for the purpose, and can demonstrate to them what he has been telling them from the platform. The difficulty is, that in large unwieldy classes, which are complained of by the essayist, and very properly complained of, it takes so long to get around

to the whole class, and to demonstrate all the operations described from the platform as to make it practically impossible. It is possible only to take up the more important ones, those upon which the whole subject may hinge; demonstrate the principles, and arrange that other things will come up in the course of the demonstration by the other demonstrators, so as to complete the subject thoroughly and fully.

Now the essayist spoke, finally, of a point of vast importance, though he did not lay a great deal of stress upon it—that is, with reference to the moral fiber of the teacher. That struck me, when I read the paper, as a thought that would bear dwelling upon for a few moments. We, as teachers, come into contact with young men who are at an age, frequently, when their character is being moulded, and if we are of such standing as teachers, in their eyes at least, as to command their respect, they will not only want to do as we do in filling a tooth or treating an abscess or in making a crown, but they are very apt to follow our example as to our morality. And it seems to me that it is incumbent upon us as teachers who come in contact with young men at this moulding period of their lives to be examples worthy of emulation. I desire to commend that part of the president's address particularly.

DR. L. S. TENNEY, of Chicago: I am very glad to be given an opportunity of commending this brilliant effort of our president. It was certainly a most interesting paper, and one that bore every evidence of careful thought and careful study. We all realize, I am sure, that he has dealt with subjects of vital importance, and that upon our ability to secure teachers well equipped, well qualified and well endowed for their work will depend, very largely, our growth and advancement in the future. It was Oliver Wendell Holmes who said: "It is not so much where we stand as in what direction are we moving." The Institute of Dental Pedagogics has always taken an advanced stand in furthering the cause of dental education and dental teaching; that, in fact, is the object for which it was created, and there is no doubt that our work is on a vastly higher plane to-day because of the efforts of this body.

I was particularly impressed with the forceful manner in which the essayist drove home the point that he wished to make. Taking as his subject the qualification of the dental teacher, he has built up a most careful and convincing argument. He has endeavored to impress upon our minds the necessity for correct teaching and correct

teaching methods. What is it that constitutes the ideal practitioner of to-day? Is it the man who goes to a college, learns just enough to get his diploma, and then goes out in the world and isolates himself from his fellow-practitioners, satisfied with his present attainments; or is it the man who regards his college education as merely a foundation upon which he must build. Certainly there can be but one answer to that question, and if we are to produce men who are of this type and are to become true professional, progressive men, then we must imbue them with the proper idea and the proper spirit while they are still within the college walls.

In speaking of the subject of the enthusiastic teacher, I recall the words of Dr. C. N. Johnson, who, in discussing this very subject, said: "In order to secure the best results in the class room the sparks must fly from teacher to student." And so it is; if we can put into our work the proper zeal and earnestness and enthusiasm we shall find that that same spirit will become contagious and will be reflected in our students. In that way, and that way only, can we get that intimate contact with mind to mind that is so essentially necessary in imparting knowledge in the class room.

When, again, the essayist said it is not so much what we teach him as what we enable him to think for himself, he touched upon a very important and a very broad subject. Some one has said that the object of all true education is to create a capacity for learning, by which is meant, no doubt, that it is not so much what we succeed in pounding into a student's head by hard labor and persevering effort as to what extent can we train and develop, and make his mind receptive; to what extent can we create in him the power of original thought and original work. Now whether this is a question to which we can devote ourselves is certainly open for discussion. It would appear not. It would appear that within the time that we now have at our disposal, it is all we can do to ground a student in the fundamental branches and to teach him the mechanical requirements of his work, without attempting the development of his intellectual faculties.

It seems to me, then, that the only solution of this particular problem is to demand a broader education before entering college. Now, gentlemen, I know this is a subject that cannot properly come before this body, because it is not in any sense a legislative body, but we can at least give our moral support, and we can let it go forth that the Institute of Dental Pedagogics stands for a higher

education, and a more extended course of study, as the essayist himself has indicated.

Whenever I look at a great body of students, many of whom are men who have not for years engaged in intellectual work, I wonder how, in a short period of twenty-one months we succeed in teaching them half as much as we do. It seems to me that that alone is one of the most eloquent tributes to the correctness of our teaching methods. I think, however, that we have about reached the limit of our attainments, and while we may hope, or may expect to improve our work, in details, here and there, yet we can never expect to accomplish very much more, until we have more time to devote to our work.

Gentlemen, I think we have every reason to congratulate ourselves on the excellent paper that our president has presented to us.

Dr. A. E. Webster, of Toronto, Canada: It was only about fifteen or twenty minutes ago that I had this paper to read over, so I may not be able to say anything in a very connected manner, of course, but I have put down a few points, which have not been touched upon.

I think this society is to be congratulated on having such a paper read before it. I never read a paper in my life that I desired so long a time to study and carefully think about what it contains. It contains the food for a great deal of thought and a great deal of work.

I might say just a few words in connection with the amount of knowledge that the teacher should have. The first thing that he ought to have is a knowledge of himself. He must have a thorough knowledge of the means by which he gains knowledge himself. Let him study that. For instance, let him take a thought and say, "how did I come to this conclusion," and think of the method in his own mind, how he obtained certain information. For instance, you see something and that suggests something else, or maybe you get a suggestion in your mind, and you do not know how it has come. It is very good study for yourself, just for a moment to think how that suggestion came into your mind at that time. That will give you a clue into the manner in which our students get their information.

Then we must know the student. And by knowing ourselves well we will shortly know the student; and when we learn the bent

of his mind we know in what direction he is thinking, and by what means he attains knowledge.

The last speaker mentioned something about the training of the mental faculties, saying that it was about all we had time for, I think, was to give the mechanics of dentistry and to give a general information. I think that is probably not quite correct, in some respects. For instance, we can teach the subjects that we are intended to teach, according to the natural means of gaining knowledge, and thereby train the mind. For example, when we expect to teach anatomy, by giving two years' lectures in the subject, and then start the student to do dissecting; is that according to the bent of that man's mind? I say not. This subject was brought up last year, and not discussed. I want to bring it up again. Take, for example, physiology, according to the method we have ordinarily in our schools—I mean professional schools, it is directly opposite to the way it is taught in our public schools and high schools—but remember these men have been taught teaching for years. How do they start physiology? Do they start from the cell and build the whole subject up from that, and go on to the tissues and the frame and make the whole man, or do they start the other way? They take the whole man and run him down to the cell.

I want you to grasp the one point; that we see and learn generals first and particulars after. That is the ground principle upon which our educators are working to-day. Do we teach our physiology that way, our anatomy that way? Do we give demonstrations first and theory last, or theory first and demonstrations last. I just want to bring that out for discussion again.

You take, for example—and we can think probably more practically of some definite thing—in dental technic, we take a whole set of teeth first, and we study the whole set, and then an individual tooth; then we take an individual tooth, and then the surfaces of that tooth—one surface of that tooth, instead of the other way, beginning with one surface of the tooth and so on, back until the whole tooth is learned and later the whole set. I know a man who lectures on anatomy; in fact, the first thing he does, he starts up with a bone in the first lecture. Who knows where that bone came from, and worse he lectures on one surface of that bone. There is no connection between what the pupil knew before and what is being presented. I do not wish to follow that subject any further—only just to draw it out for thought.

Now the question of lectures, whether we should demonstrate or lecture, and so on, amounts to but little in my mind. I think a great deal depends upon the teacher. A man who can teach well by lectures I think probably would do better to follow that rather than go into a business that he is not fitted for.

To the man who quizzes well, it would probably be foolish for him to try to teach without that aid. As a lecturer has said, have every means possible to give instruction. Make a fine distinction between what is knowledge and what is mere information—that must be made by the teacher.

The essayist drew attention to one thing that is very important, and that is, not to stifle the individuality of the student. Let your student be a man from the time he comes in until he leaves, and just as much an individual, and not a class. How much simpler it is in the class room to have every man working, every man interested, every man putting in his say. Compare that with the method of the man who is highly respected and stands off and gives a cut-and-dried lecture. The student does not have anything to do with it and is consequently not interested.

In lecturing, another point that I wish to draw out is, to be guided by the circumstances at the time of lecturing. It will not do to prepare a lecture and follow it right up in detail. For instance, you find frequently that you come to a point where the student knows all that you are talking about, which would necessitate a change of plan—how shall we know? That seems to be difficult for some men, quite simple for others. How do we know whether the students are interested or not? The sparks must fly, as the last gentleman said, and you know, by that means. When you don't know, stop and quiz and find out. You can find out readily by the eye on you—and unless you get the eye on you, you might just as well sit down. I prefer, myself, to lecture this way, not to fill out the whole hour and twenty minutes or hour and a quarter. When I find that I have finished, or we are all through, giving close attention—we are doing this thing together, and the boys are through, to stop—there is something wrong. It is not something wrong in the student, either, it is something wrong in Number One when the students do not listen. Sometimes I lecture an hour and a quarter, sometimes ten minutes, and sometimes even less than that; and if you find the lecture does not *go,* you might just as well quit and stand out before your class and say, "Gentlemen, there is something wrong, we will

quit and try this in the next lecture," and think about it, doing it in a different way next time. I have frequently said to the class, "This lecture is a failure, let me try it again." It is all right; the student doesn't mind it a bit. Try it. Next time you will do better.

I wish to congratulate the president for his excellent address.

Dr. W. C. Barrett, of New York: After making all the necessary preparations, at the last moment I find myself unable to attend the Nashville meeting, and in accordance with the request of the committee I write out and send that which I was invited to present in person. I am deeply impressed with the thoughtfulness of the address of the president, which I have been permitted to read. If all were imbued with the spirit exhibited in that paper it would be the better for dentistry. It is broad and catholic in its tone, and is redolent of a devotion to duty and a self-abnegation that is very refreshing in this mercantile age. I cannot hope to strengthen it by any words of my own. May I not be permitted to supplement it by adding another phase, and may I not be forgiven if I speak plainly and even bluntly, always remembering that it is honestly and sincerely and in the spirit of love for my profession and my professional brethren.

Last year this association appeared to have come to the parting of the ways, and a departure from the traditions of the past was made. The very name of the society was changed, and to some of us old fogies it was for the worse. The new cognomen may to those who are attracted by mere sound be more pretentious, but if a more priggish, presuming title was sought, the best of all those offered was not selected. A still better one might have been something like this—The World's Solidarity of the Pedantic Pedagogues of the Universe. That name would have given plenty of room for future growth, and certainly no fear of being considered ridiculous would have restrained us. This society was originally formed to foster the teaching of technics in our dental schools. That branch of our professional education had been sadly neglected, or had never been developed, and it was most distinctly a step in advance when it was sought to make more prominent in the curriculum of our colleges the training in manipulative skill upon which our practice so broadly rests. To perfect the coming dentist the education of his hand must accompany that of his head. His mechanical intelligence must keep pace with his mental growth. The brain which

can conceive is useless without the fingers that can execute. So far as dental practice goes, the student might as well lack his head as to be without his hand. If I had a tooth to fill I think I should prefer the man who knew practical dentistry and nothing else, to him who knew everything except just how to do that particular thing.

Americans have always been a practical, ingenious people, who usually found the shortest route to the end sought. The fact of their segregation territorially from other nations, the necessity for subduing a wild country and out of the primeval forest and prairie to elaborate a civilization of our own, has made us in some respects different from the nations who have through many generations inherited their training and habits and methods from their ancestors. The very conditions under which our national character has been formed have proved an apt soil in which to grow that peculiar manual dexterity demanded in dental practice, and with the dawning profession there sprang up a class of men who soon became the most skillful operators of the world. But they lacked in the mental discipline which is obtained chiefly from an extended scholastic course. Dental professional schools were first established in America, and the building up of a proper curriculum of study was a matter of experiment, for there were no old traditions to serve as landmarks. What was chiefly lacking at the outset was a rigid system of school training in natural philosophy and abstract principles, and that the National Association of Dental Faculties is to-day gradually developing.

But hand in hand with this work must go the physical education and the manual and digital training by which alone can artistic dexterity be acquired. The expert pianist must begin this physical discipline at a very early age if he hopes ever to acquire any great proficiency. The music teacher commences to spread the hand and to give mobility to the fingers and independence of action and distinct individuality to the thumb as soon as the child can sit upon the stool. Even with the highest natural mechanical intelligence years of stern drill of the muscles are absolutely essential. It is not sufficient that the average American has good mechanical sense and aptitude in acquiring skill in handicrafture. That innate capacity must be properly directed, and that latent talent developed through systematic manual training. One of the most hopeless students who was ever my pupil in college

was one who had graduated abroad in almost everything. From a German gymnasium he had gone to the university and completed the course of study there, graduating with his M. A. He had then taken the full university medical course, graduating again with his M. D. After this he had spent some years in post-graduate study, including lectures in dentistry. At twenty-seven years of age he came to America with one of the best-stored and trained minds conceivable, but with the most ignorant hand ever attached to a human arm. He could form no mechanical concept of a piece of work, and could he have done so he had no hand educated to perform it. It took two years to teach him how properly to grasp and manipulate an excavator.

There was, then, a few years ago, a great field for the exercise of the energies of the Technic Association. There was a distinct work for it to do—a branch of teaching otherwise neglected. During the very few years of its existence it has accomplished great things in systematizing the instruction of the hand. It has been steadily making progress, and it has bid fair to give to American educational methods a supremacy that would be undisputed in the very field in which our profession has won its greatest triumphs. But last year thoughtful men observed with pain a tendency to forsake the useful for that which was thought to be more ornamental—gradually to abandon a field in which those engaged in the work were acknowledged experts for one seemingly more pretentious, but of which they were in almost dense ignorance. It appeared like an outcropping of that spirit, born of a lack of knowledge of the fitness of things, which prompts the trustees of some young and beautiful and rapidly growing country town to change the pretty, appropriate names of its streets to such monstrosities as "National Avenue" or "Hawthorne Place," when not a resident would be able to recognize a hawthorn if he saw it; or to ape larger cities by calling them "Broadway" or "Pall Mall," forgetting that in so doing the width and character of the street does not expand with the name, and that the assumption of great city airs only makes the inhabitants ridiculous.

The definition of technic, or technique, is, The doctrine of the arts in general; the details of the mechanical performance in any art. What more expressive name for our society could have been chosen than that which so exactly describes its function? Pedagogics means pertaining to the science and art of teaching—the methods of the schoolmaster—the pedagogue; the latter term com-

monly being used disparagingly. What could be more absurd than for this association of professional men to assume the pedagogue, or to pretend to be expert in the methods of the schools? That is peculiarly the branch in which they are least skilled. We are *not* pedagogues. Teaching is with us only incidental. Our livelihood is obtained from the practice of our profession. There is not a man among us whose life is devoted to the calling of the pedagogue, nor one who gives his whole time to instruction, unless it is in a very subordinate position, and even such teachers necessarily teach technics and have nothing whatever to do with pedagogy as a science. It must have been ignorance of the real situation and of the significance of words that prompted the movement of last year, or it was the result of lack of thought and consideration. That certainly is how it appears to the old fogy.

I desire to enter my earnest protest against any such shifting of policy and such vain assumption as the change made last year seems to indicate. I hope that we may stick to the old paths of honor and return to the title under which this association won its triumphs in the past years, and that its scope will be confined to the field which it is so competent to cultivate, and that there will be no attempt made to invade the realms of pedagogy or to pose as members of a calling which certainly is no more honorable than that which is legitimately our own. Let our greatest pride be that we are dentists, and dental teachers if you will, and not schoolmasters.

Dr. G. E. Hunt: The chair can hardly conceive of any set of remarks that would have been more conducive to the writing of a paper such as the president wrote than those that have just been read by our secretary. For the dean of an institution and a member of this association to say that teaching is merely incidental in his career, or that he does not see any necessity for us being trained teachers—which is practically what he does say—is in the nature of a surprise, surely, to this body. Up to this point, it seemed to me that the discussion of the question had been pretty completely concluded, but with this last communication on tap, I will announce that the discussion of the paper is still open, and we will be glad to hear from any or all of you.

Dr. Thomas E. Weeks: Mr. President, there is one point touched upon in the paper which naturally appeals to us, and I would simply emphasize what was said about holding school for the demonstrators; that is, the necessity of all the teachers getting to-

gether and comparing methods; the younger men will naturally gain from those of more experience, and their energy will be transmitted to the older men, who, it was hinted, might become a little careless sometimes. We have found that the acting together of the whole body, including the teachers of the primary branches in medicine, has been of wonderful benefit to all of us. Then the different departments—that is, the chair of operative dentistry, for instance, gathers his teachers about him, and they discuss what is being taught, and how to teach it, in operative dentistry; the lack of normal schools in which teachers may be trained can in a measure be compensated for by this method of having frequent meetings of all the teachers, and between times meetings of the teachers interested in special subjects.

Dr. J. H. Kennerly, of St. Louis: There seems to be one point that particularly attracted my attention in the paper, that of personal contact with the student. Until the present term in my capacity as teacher of prosthetic dentistry, I have had the privilege of teaching prosthetic technic also. I have found that by personal contact with the student from the time of his entrance into the school, it is not very long until, as one gentleman remarked, the sparks began to fly. By personal contact with each and every man you can find out where he is principally lacking, where he failed to grasp what you particularly desired to teach him. The present term I do not teach prosthetic technique. There are a good many of you who know that I have changed from one school to another, where I unfortunately fell among a class of students, not one of whom I knew, and consequently my work as a teacher this term has been one of unusual hardship on account of the lack of that personal contact and acquaintance; and, gentlemen, I want to say to you, that there is no point mentioned in the paper that is of such great help to the student as well as the teacher. Get in close contact with your students; the earlier this contact begins in the history of the student the more or the better will be the results accomplished.

Dr. Brown, of Milwaukee: I would like to drop a little oil upon the discussion, if I can, in relation to thoughts suggested by Dr. Barrett's discussion of the paper. It seems to me that he brings this question before us in something of a wrong light. What he says is true enough, beyond any question, but to my mind it is because of all that the Technic Association, considered in its limited sense, has accomplished, that we are now ready to do something more.

We realize through having accomplished so much by the systematic development of one portion of our work, that now it has become necessary for us to systematize and become skilled in other branches of the work. Therefore, it seems to me, regardless of the name, that the change in the purposes of this association, or a broadening and continuation of its purposes, if you may so call it, was decidedly opportune—was by all means the thing to be done, and I think the discussions of the paper, as well as the president's address itself, have certainly demonstrated to everybody the fact that we are now ready to take a great step forward.

Dr. T. W. Brophy, of Chicago: I listened with a great deal of interest to the reading of the able paper by the president. I do not know that I can add a word to what has been said in complimenting him upon the discussion of the subject, except to say, in illustration of one feature of the paper, that a year ago now, after the meeting of this association at Philadelphia, I took a trip down South with my friend whose written discussion has been presented, and we visited one of those beautiful old southern homes in Columbia, S. C., and found in that home a large family. There were ten children in the house, and as we sat at the table these children, the smaller one next to the mother, and so on, ranging up next to the father, presented a most beautiful sight; and while I was down there I never heard a word said in that family about it being large and unwieldy. That is the feature of the paper that I want to discuss. What does the gentleman mean by saying that the class is large and unwieldy? I never heard any such remark made by the teacher from a school where they have large classes. And personal contact is another question. What is meant by personal contact? Is it meant that the teacher—the head of the department—is to have personal contact with each student of his class, or does it mean that his so-called unwieldy class cannot by careful management have its work so systematized that each student will receive personal contact from his teacher. Does it mean that one man is to teach all the class, or is it intended to have the class divided into small classes with an able teacher at the head of each small class, thus giving personal contact with the students? A large family is trained and educated so that each member may become just as useful a member of society, and far more so, than you would get in a family where there is but one child. Now I did not like that phase of the paper and discussion, because a large institution, a large government or a

large corporation may be conducted with just as much care, and each individual acting within the domain of the government or the corporation or the association, may be just as carefully managed as though there are only a few. I think that is the weakest part of the discussion that has been entered into here this afternoon.

There is one feature of the discussion I particularly enjoyed, and that is the remarks of Dr. Kennerly; and I see more clearly than ever before the wisdom of cutting the great canal between the City of Chicago and St. Louis, for I have learned for the first time that it has caused the sparks to begin to fly in St. Louis.

Dr. G. V. Black, of Chicago: I was unfortunately out a few moments and failed to hear the reading of the address. For that reason I did not feel like entering into its discussion. Of course, I got some idea of what it consisted from hearing the discussion. The paper presented must have been an able one, to call out such a discussion and I have been very much pleased. I might say a word as to the change of name. I should certainly differ materially from the ideas presented in the discussion by the gentleman from New York, for the reason that I have seen in the tendencies of this association a desire to enlarge the range of subjects taken up. The fact is, that this is the only association of *dental teachers* in the United States in which the subject of *teaching* is discussed. The Faculties' Association, as we all know, is occupied with legislative work, and the subject of teaching is not entered upon at all in that association, and therefore this is the only association for the discussion of such subjects, and the desire has been very generally expressed that this association take up the whole range of dental teaching.

Now, gentlemen, whatever may be our standing, individually, in the practice of dentistry, if we enter a school room and undertake to teach, we either become teachers or failures, and if we are to become teachers we must study this subject of teaching—pedagogics, if you please. It is as necessary that we study the subject of teaching as it is that we study the technical procedures in our operating for our patients. Or, as we study the conformation of the tooth when operating for our patients, so we must study teaching when preparing to go before our students. We are endeavoring to instruct, therefore we are teachers; we are a body of teachers, and the study of methods of teaching is our business here. We study particularly the methods of teaching in dental schools, but in studying the method

of teaching in dental schools we must study the principles of teaching in general.

PRESIDENT H. P. CARLTON: Fellow members, I want to thank you for the kind reception you have given my effort. I am more than pleased, especially after hearing the remarks of Dr. Barrett, because he has given his attention principally to the name of our association instead of to the address. I must confess that it was with some fear and trembling that I read his name among those listed for the discussion of my paper, because I expected that he would handle me severely. My efforts were intended to be directed purely and solely toward the *ideal* in teaching. It was not a comparison or a criticism of any class of teachers. I wished simply to draw as far as I was able a *picture* of the ideal teacher, as I had him in mind. I wish to thank you very much, also, for the discussion it has brought out. If it has done any of you as much good as it has me I shall feel satisfied.

THE USE OF FLEXIBLE RUBBER DUMMIES IN ORTHODONTIA AND OTHER TECHNIC TEACHING.

By J. Q. Byram, D. D. S., Indianapolis, Indiana.

That method of teaching which enables the teacher to intelligently explain his subject, and the student to comprehend clearly that which is being taught may be considered the best. Methods of teaching, like methods of operative procedure, give different results with different individuals; likewise one teacher's methods, be they ever so good, may be of little service to another. In this progressive age, those of us who care to keep abreast with the times must continually seek such methods as will yield the highest results.

The use of flexible rubber dummies in technic teaching is in its infancy, still the field of usefulness is already wide. I am a strong advocate of this method of teaching both operative and prosthetic technic, for with properly constructed dummies all operations can be taught in a skillful and scientific manner, and the principles of some operations can be taught better with dummies than in the mouth. The use of these dummies in technic teaching opens a field for great opportunities. I have been experimenting along different lines for the past year, and find the work both pleasant and profitable. I wish to thank Dr. Webster and others for valuable suggestions on the use of flexible rubber in this line of teaching.

Orthodontia technic is a hard subject to teach, because the correction of irregularities is based on varied mechanical laws and scientific principles. Unless the student is familiar with these laws and principles, or has them demonstrated to him in a practical manner, he cannot have a full conception of what is being taught, or what he is trying to do. If a student construct an appliance on a plaster cast, he is taught that this appliance will produce certain results provided the proper mechanical laws are applied, but in many cases the rigid cast does not enable him to see the particular application to the case in hand. So what we need is some method by which we can show objectively just how these laws governing

force are applied. Some may say let this be demonstrated in the mouth. Theoretically, this is very good, but, like clinics for other departments of technic teaching, there is such a dissimilarity in the cases presented that it is difficult to secure material for the case in hand at the proper time. By constructing a number of flexible rubber dummies, representing the different classes of irregularities, we may have a stock of models for demonstration. When the student constructs an appliance for a particular class of irregularities, if he has a dummy representing this class before him, with an appliance adjusted, then he can see the force applied, and at the same time he has a pattern for constructing an appliance.

Dr. Case did us a valuable service last year when he presented a syllabus for teaching orthodontia technic. I agree with him that the first training a student should have is to construct some of his tools, his stock material and appliances in general. But I believe this should be the secondary object of his work. The primary object should be to work out certain mechanical laws governing the application of force, for the appliance is only the machine, by which the application of force is accomplished.

I fear there is a tendency to make a machine of the student by looking too much to the mechanical side of our work, without involving principles. This will be the result if too much stress is laid on the construction of appliances without demonstrating their proper application. Any student can be taught to do most operations in a machine-like way, but, after the operation is completed, he has very little knowledge of it other than what he gained by merely going through the different steps. It may be asked if he can go through the different steps of the operations—has he not obtained the desired results? While he may have obtained results, he has not obtained the highest possible results.

It is not my object to go into the technic of constructing appliances or the methods of attaching them, but to present my method of demonstrating the application of force by the use of flexible rubber dummies. First, I have dummies with normal arrangement. You will see how the teeth can be separated by the use of elastics, floss, wooden wedges or the mechanical separator. Second, I have a lingual displacement of the superior lateral. The appliance used makes a pressure toward the labial on the lateral, at the same time forcing the central and cuspid apart. Third, I have a labial displacement of the cuspid, and a rotated central.

The appliance for retracting the cuspid demonstrates the force applied so that it is drawn distally without affecting the bicuspids or molars. The appliance for rotating the central demonstrates the force applied to it without affecting the other teeth. Fourth, I have a constricted arch. This appliance demonstrates the force applied so that the whole arch is spread, and at the same time draws the incisors distally. Fifth, I have an upper protrusion. This appliance demonstrates the force applied, so that the incisors and cuspids are moved without affecting the bicuspids and molars. The next appliance is for elongating an incisor or cuspid where a small portion of the incisal edge has been broken by accident, but not enough to require restoration. This appliance was designed and constructed by Dr. Alex Jameson, of Indianapolis.

I will only speak of a few of the uses of the flexible rubber dummy in teaching operative technic, for Dr. Webster demonstrated the use of this dummy at Cincinnati in 1898. The interproximal space is filled with a soft elastic substance which approximates the natural gum. This allows the cervical margin of the cavity to extend under the "gum margin." The teeth are arranged as they are in the mouth. The student can see to a better advantage why he should make the margins self-cleansing. He also gets a clearer conception of preserving the contact point, and the principles of wedging. He is working in proximity to the other teeth, so that he must insert the filling material more accurately. He can be taught how to adjust the rubber dam and the use of ligatures. Also the application of all kinds of rubber dam and cervical clamps. With properly constructed dummies he can also be taught the different motions used in extracting.

I consider the flexible rubber dummy to be the best appliance to approximate the mouth for crown and bridge technic. A few of the advantages are: The crown can be constructed under the same conditions as though the student were working for a patient except treating the pulp canal. There is a free gum margin to which he can fit the ferrule almost as accurately as though he were fitting it in the mouth. He gains the experience of shaping the tooth. The interproximal space is filled with an elastic substance, which gives the same effect as gum tissue. The contact point can be preserved as well as in the mouth. Take the construction of a Richmond crown as an illustration. The root is properly shaped and the canal enlarged. The ferrule is fitted to the root and an im-

pression of the ferrule and adjoining teeth is taken. The crown is constructed from this point just as though the work previous to taking the impression had been done in the mouth. When the crown is finished it is fitted to the dummy. The student can now see if the crown has the proper alignment, length, contact, etc. All shell crowns are made on the dummy, using the same principles as though they were made in the mouth. The dummies for bridge technic are constructed to represent partial dentures. There are the same advantages for this work as in crown technic. The method is to construct the crowns, fit them to the dummy and take an impression. Construct the bridge from this point as though it were for a patient. When the bridge is completed it is fitted to the dummy for final adjustment.

I said in the beginning that the use of flexible rubber dummies is in its infancy. I see several improvements that I expect to make next year. One change in my crown and bridge technic will be that each freshman will construct a full upper and lower denture, the lower to be preserved for use in the junior and senior years. The junior constructs the flexible rubber dummy for crown technic to occlude with this lower. The senior constructs the dummy for crown and bridge technic to occlude with the same lower. By using this method of constructing the dummies, all crowns and bridges can be made to an occlusion.

I find the edentulous flexible rubber dummies mounted on an anatomical articulator very valuable in teaching prosthetic dentistry, as well as prosthetic technic. These dummies are mounted on Gritman articulators, giving the lower jaw the natural movements. I use these dummies in the following way: Each freshman takes impressions of them in plaster of paris, constructs the casts, and base plates for the bite. He then takes a base plate bite of the dummy. The length of the bite is determined by arranging the set screw on the articulator. He then constructs the dentures from this point as though they were for a patient, and when they are completed he fits them to the dummy. You can see by this base that the finished work fits the dummy quite accurately. Each junior takes impressions of this style dummy to obtain dies and counterdies for constructing swaged metal bases. I have here another set of dummies mounted on a Gritman articulator. The upper represents a flat mouth with a hard palate. I failed to get the results I hoped to obtain with this, but the effect of the hard

palate is fairly well shown. The lower represented a ridge with marked absorption. I have a number of dummies like this which the freshmen take impressions of, for constructing cast metal dentures.

There are a number of advantages for using the flexible rubber dummies mounted on Gritman articulators. They can be made to approximate the mouth better than metal dummies. Plaster impressions can be removed from undercuts. The student can see the possibility of the patient protruding the lower jaw or closing laterally when taking a bite. A series of dummies representing mouths from the normal to the abnormal can be made. By vulcanizing the metal bows in the dummies one set can be removed from the articulator and another be adjusted without any inconvenience. The bite can be raised or lowered, and the dummies can be arranged to represent an upper or lower protrusion. A large number of similar dummies can be constructed from the same mold, so that any number of students can do the same work at one time.

The next dummy is used to take impressions of, for constructing appliances for cleft palate. This dummy is very crude, and I hope to have a better one to present to you next year. As far as I am able to learn, the construction of appliances for cleft palate has not been added to a technic course until this year. Each college has a number of cases of cleft palate during the session, but this class of work is so limited that only a few students get the practical benefits. I have a number of dummies of which this is a fac-simile. Each junior and senior constructs an appliance with the velum attached to the vulcanite. Next year I propose to have each junior construct a similar appliance, but each senior will construct a metal base with a detachable artificial velum. This gives each student a practical knowledge of the technic of taking the impression, constructing the cast, properly waxing the case, burnishing tin-foil, packing two kinds of rubber, swaging the metal base, constructing the mold for vulcanizing a detachable artificial velum, etc.

I am not satisfied with the method of producing the teeth used in the flexible rubber dummies, for operative and crown technic. A portion of the student's time, consumed in producing these teeth, can be used to a better advantage. Dr. Webster requires his students to carve the fourteen teeth in modeling composition, and

then reproduce them in white vulcanite. I require each student to buy two "Weeks" tooth forms. He then dissociates the teeth and reshapes them. It is almost impossible for each student to have typical forms of teeth for the flexible rubber dummy if he carve his model teeth in modeling composition, and then reproduce them in vulcanite. Then it takes too much time to produce the teeth by this method. It is impossible to get typical forms of teeth unless they are reduced in size when they are reshaped from the "Weeks" tooth form. I consider the time required to construct the flexible rubber dummy after the teeth are produced well spent. The student gets the technic of constructing a denture along with the many other practical points.

If a number of colleges can be interested in this method of technic teaching, we can get some manufacturer to furnish the vulcanite teeth at a nominal cost. These teeth will have all the lines, grooves, cusps, ridges, fossæ, etc., on the occlusal surface, but the axial surfaces will be parallel. The student should then shape each tooth, giving it a bell crowned appearance.

DISCUSSION.

Dr. W. E. Grant, of Louisville: I am glad that Dr. Byram has presented this subject to-day. While some teachers, I know, have been using it for several years—some two years, rather, since it was presented by Dr. Webster at Cincinnati, as noted by Dr. Byram, at the same time it contains some additional valuable suggestions that I am certain we can all profit by.

There were a number of suggestions thrown out in the paper as to the use of flexible rubber that had not occurred to me. After the demonstration Dr. Webster gave us in Cincinnati, Christmas two years ago, opening in January, as our school did then, I was able to put it into immediate practice, so that we have been able to use the flexible rubber in the construction of the tooth form, and also in the last two sessions, used it in connection with the orthodontia appliances, and I am glad to commend them very highly. Of course, as Dr. Byram said in the beginning of his paper, all the students are not able to use the same material nor the same methods and accomplish any kind of satisfactory results.

There were some suggestions thrown out in the paper that probably would not be considered practicable by some of those present, but the others, I am sure, they would accept and use, and only would

require the use of this flexible rubber through one session to demonstrate the advantage of it in teaching technic in the various departments. There is one trouble, however, in the technic work, and that is something that we have to guard against—the liability of making our men mere mechanical machines. We had better give them less and have them better understand the principles which underlie the subject. Let us not try to have them make too many things in operative technics, orthodontia technics, or in prosthetic technics. What we do require of them extend to the point where they are able to apply the principles. Now our tendency—we talk about this subject of technic so much—is to multiply the requirements all the time, requiring a large amount of work of the student without teaching him what he needs. We want to teach, not simply instruct. The point was made by Dr. Byram that some say why not require the application of these requirements in a practical way in the clinics. I believe, however, that there is no operation of any consequence requiring the exercise of mechanical ability, but what ought to be done in a technic way outside of the mouth before it is attempted to be put into practice in the college clinics. I do not believe, however, that with the short term of three years and seven months this is practicable. Before we can hope to do everything—that is, I mean all operations of any consequence of a mechanical kind in a technic course, we must extend our term at least another year.

Dr. Byram mentioned the advantage in demonstrating the contact points and the restoration of tooth structures in his paper. I want to say that I was not able to have my class appreciate what I meant by the restoration of the tooth structure and the bringing out of the contact point until I used this tooth form. He also laid some stress on the carving of teeth. I like to require considerable carving. It helps to teach them anatomy in a way superior to any other. The question is, how much carving? Thus far we have required them to assemble, or make, in some way, the fourteen teeth, to carve them in the white rubber, and then arrange them and finish them on the black flexible rubber base. I would also say that the flexible rubber is not only valuable made in the forms that Dr. Byram has presented, but also in various other forms; used, for instance, for duplicating purposes, getting out a number of casts—using it sometimes as a base for the making of the various casts, and, for instance, in your prosthetic department, you desire your students to

make a certain piece of work, and to make fit the same cast by using the flexible rubber cast it can be accomplished nicely. I didn't notice that suggestion, but we have used it in that connection.

DR. D. M. CATTELL, of Chicago, Ill.: I have but little to say, as the subject is one that I know very little about, except from the standpoint of technic work. I can only understand the result of the technic training as seen in the orthodontia department of the infirmary. The experience had in watching the result of technic teaching in practice as found in the dental infirmary, and there the teaching that has been previously given in the orthodontia technic should be put in practice.

Ever since there has been work along the line of technics in orthodontia there has been a great increase in the amount of practical orthodontia in infirmaries. A few years ago, and but very few years, in the majority of schools, the regulating of the teeth was almost unknown in the infirmary practice. It has been slowly growing, but it never took a position worthy the name until the technic work was introduced, and after that the practical work was made much more sure.

Now in several schools that I have seen and know of—in fact, the school that I am connected with—the practical orthodontia work is not what it ought to be. Why? Because it has been all but impossible, so far, to get a competent teacher in orthodontia technics.

One objection I shall make to the paper or to the idea given there, which was referred to by Dr. Grant, and that is, the application of the principles involved. Now, gentlemen, my idea is that this paper is on *technics,* and not upon the principles to be applied as taught from the chair. I draw a broad line between the general principles that may be taught from the chair of orthodontia and the technic work of making appliances in the laboratory. When the student knows how to make the appliances, the technique, then listens to the lectures from the chair of orthodontia, he will understand the principles that may be there laid down; but to take principles before he knows how to make the appliance to attach to a case involving a principle, it seems to me that is teaching differently from what I conceive to be the proper way. It has been, as you know, the idea of technic teachers, that the technic work comes first. That technic work is in the beginning of the course, whatever it is, no matter whether it is in the first or second year, the technic first, then the greater principles involved coming after. So that while

it is a fact that on these models or on anything that we may produce in the technical laboratory, we cannot so well teach the principles, but our object there is to teach the making of the appliances, how to make them, what to make and so on, and afterward teach the principles. I judge the majority of schools that teach orthodontia technic teach it in the second year, while it is the third year that the principles of orthodontia are taught from the chair, pupils meeting the practical cases in the infirmary. At least, that is as I have learned to understand the way that most schools teach. Some, of course, may teach their orthodontia technic in the first year, but we never expect a student to come in contact with the actual cases in the first year, not until he has passed on to the infirmary or practical work.

Now in regard to the peculiar method of teaching, referred to in the paper, I cannot but think it greatly in advance of many things we have had. As we all know, last year was the first time that the subject of orthodontia technics has been before this organization as a distinct specialty. Dr. Case's paper of last year opened the field, and surely we are growing in that work. The flexible rubber in orthodontia, as well as in other fields of work, is certainly a great advance, and I am glad that it is coming into more general use, and I believe that within a few years, as we know better how to work it and as we find out different things that it may be utilized for, we will find that we cannot do without it. And I have heard of more new things that are to be presented along these same lines.

But the one point that I would like to emphasize before sitting down is this: That it seems to me so many fail to disassociate two ideas. The one, to be presented by the chair of orthodontia or the chair of any subject, and the other, the work done in the technic laboratory—the manual training, the finger craft.

Now we used to call ourselves an association or school of technic workers, and while we were in that, if you remember, we left the greater principles of those things that were in the practical course of the work—infirmary work—alone; while we were working in that technic field it was that we grew. It was our *technic* work, gentlemen, and that alone, that has put us where we are to-day, and had it not been for that technic work, letting everything else alone until we had that well in hand, we would not have been sitting here to-day in the broader field of pedagogics.

Dr. Alexander Jameson, Indianapolis, Ind.: I was informed

at this morning's meeting that I was to take up this discussion. I have been more or less familiar with Dr. Byram's work in the past, and I know that he has put a good deal of time upon this, he has been very earnest about it; and it seems to me that if there is any one thing that can be said about it, it is that there is even a broader field for it than he has given us to understand. There have been some objections and some difficulties to be overcome. His idea was to use the ordinary vulcanite tooth form and imbed it in this soft rubber. In speaking of this to several gentlemen the other evening it was suggested by some one that bone or ivory be substituted—that is, that the carving go on as it is in the laboratory and that the carved teeth be used in the forms. Now that cannot be done in one way, and it can in another. For instance, you cannot vulcanize to this ivory or to this bone, but you can make a counterpart of the ivory or the bone in metal and then vulcanize around them and withdraw them and then insert your teeth. In addition to this, I have thought of several new features. I suppose they are new. I think this one is essentially new; in vulcanizing our teeth we can vulcanize them with the root canals in position, and thus teach pathology in a way that we do not teach it now, possibly. There is an old saying that "the grave hides a physician's mistakes." It don't hide the dentist's mistakes, and we know there is very little danger of having too much technic. I think this work is especially desirable in orthodontia technic. There is a little bit of selfish interest connected with this. I hope by next year we will have a number of typical cases made up of this kind,, so that—while we do not want, of course, to get the chair of orthodontia and technics together in any sense of the word, if we have a number of models of typical cases—it will aid the lecturer quite a good deal in just that kind of work.

Dr. A. E. Webster, Toronto, Can.: I understand that Dr. Byram has devoted, in fact, all of his time to this work of technic teaching, but it is only what we may expect, just so soon as a school comes to the conclusion that they will employ teachers to give their whole time to the subject they will produce something that will be valuable in the line of teaching; so in this case, and you may expect in any school where you have men devoting their time to teaching, and think of teaching twelve months in the year, they are likely to produce something at every meeting that we have that is of value in this work. I wish to thank Dr. Byram for a great number of suggestions that he gave here over anything that I have done in it

myself. Then, again, there are some suggestions that will be brought forth later in the meeting that are different from these, that we may consider very important. There are a few things in connection with this orthodontia question, Dr. Cattell said, with reference to the teaching of orthodontia not being what it was desired in a great number of schools. I have charge of that department, and I can tell him why it is not up to the mark in our school, is because it is so difficult to teach. I never tried anything so difficult to teach as it ought to be done. It seems so hard to get a sufficient number of examples to show to the students, of the work that you are trying to do, to demonstrate the principles.

Now, first, is the difficulty—spoken of also by Dr. Cattell, of separating entirely technic from principles. Now, just as soon as you do that you will lose the interest of your student. "What has this work to do with dentistry?" you are asked immediately. And I will tell you, that is a stumbling block. The student must know at every step what the question in hand has to do with dentistry, and if he does not know he should be informed, and then he is interested, and without that interest you would do nothing—you might just as well be talking to the wall. So that in every step, no matter what you are teaching, that man should know exactly why he is doing that work. I should not think of asking a man to carve a tooth without showing him plainly where he would need that work; and, in fact, I never ask a man to do anything; he desires to do the work prescribed. I ask one of the boys, why are you doing this work, why are you carving this tooth, why are you doing this particular work, why are you making this nut, why are you making this tap—he must know. If he doesn't he will have but little interest in his work and will not do it well. If you are going to make a mere mechanic out of a man and want to give him a good finger technic for it, very well; but why not make the subject alive at the same time by giving him an interest in his work.

The lapping of one chair over another is a difficult question, and it will always be hard to solve until one man has charge of the whole work from the very bottom or freshman class to the top or graduation; if a teacher is good enough to give the first ideas of a subject he is good enough to give the last ones of it, because the first ones are the ones that stay. A man is never too good, never too brilliant a teacher to teach by the demonstration method. I never saw any one yet who was too brilliant a teacher to waste his time on

a demonstration. In fact, he will teach more by a demonstration than he will by all the words he will ever use in that connection.

I wish to thank the gentlemen for their attention; and I wish to thank Dr. Byram for his paper.

DR. O. A. WEISSE, Minneapolis, Minn.: I was glad to hear what Dr. Webster had to say in regard to the difficulty of teaching orthodontia technic. None but those who have had experience can realize how difficult the subject is. . It is not at all strange that it should be a difficult one; it is one of the newest subjects that we have in dentistry. It has not been reduced to exactness like some other subjects have been, and that is one of the reasons why it is difficult.

I believe that the best way is to teach the technic first and the principles of orthodontia afterward. Have your technic simple. The method that I pursue is this: I make up a case of the common forms of irregularity in order to avoid having to make so many casts to illustrate each of the appliances. As many appliances as can be put on to one cast are applied, and the rest of them are applied on another cast; but every student is given to understand that each one of these appliances is to illustrate a certain principle and each case of irregularity is either a simple one or a complex one, and when they have made the appliance they see at once just what that appliance is to do.

The principles involved in correcting irregularities are all left until the third year. I do not think that it is the proper thing to give the student too many things at one time. We must remember that while some of our students graduate from high schools and some from universities, their minds are young ones, after all, in this line of work, and if you try to put too much before them at once you confuse them. It is all well and good to interest them, but there is a limit.

DR. J. D. PATTERSON, Kansas City, Mo.: I wasn't going to say a single word after Dr. Webster spoke, because he expressed my views precisely in regard to some remarks Dr. Cattell made; but since Dr. Weisse has so strongly reiterated the statement made by Dr. Cattell in regard to the importance of disassociating the technic work and the teaching of the principles for which that technic work is undertaken, I want to express my wonder how such a stand can be taken by a logician or by a scientist. We must *associate* them, not *disassociate* them. They have said, both of them, with a great deal of impressment, that they must be disassociated, and yet have

not given one single argument for that separation. I do not wish to take up time any longer.

Dr. Thomas E. Weeks, Minneapolis, Minn.: I think the gentleman who last spoke misunderstood Dr. Weisse, or else Dr. Weisse did not make himself clear. In the first place, Dr. Weisse teaches both the technic and the principles, and he simply dissociates the time, not the principle and the technic. The principles go all through the technic of everything that is taught by Dr. Weisse.

Dr. J. D. Patterson: He said he didn't teach the principles until the third year.

Dr. Thomas E. Weeks: The principles of the movement of the teeth, doctor; he meant to say the principles underlying the great subject of orthodontia, and if you will attempt to put that into a man's head before he becomes somewhat familiar with the subject through the making of appliances which he has been shown what they are for, before he is asked to make them he will make a sorry mess of it, in my opinion.

Dr. Patterson: Put them both together.

You cannot do it.

Dr. G. V. I. Brown, Milwaukee, Wis: I think these gentlemen have confused two terms; they have confused the term principle with that of practice. In technics you have, of course, principles. All technic work is based upon principles, but I do not think any one would argue that it is wise to mix practice up with technics. When Drs. Weisse and Cattell spoke I think what they meant they didn't wish taken up is that mixing of practice with this matter of technics.

While I am on the floor I wish to call attention to one little modification which I have seen fit to make in this work, and I would like to have those who are interested look at it in the exhibit which I have here. When we put the flexible rubber model into the articulator to work upon we have found that it is a good plan to attach a piece of rubber dam, a piece long enough to imitate the cheeks; running from the superior to the inferior model. For instance, in taking impressions, the student inserts the tray as he would in the mouth. We have expected this year to add this feature also to the technic of filling. After a certain number of the fillings have been put in we expect the last five to be put in with this imitation mouth. He has to fill this tooth in a darkened space, very much like the mouth—about the same opening; his hands, of course, have to be used to hold this flexible cloth away and hold a mirror, much as he would be obliged to do in working in the mouth.

Dr. A. E. Webster, Toronto, Can.: I want to say something in reference to what Dr. Brown has stated. While in Paris I noticed a head for teaching that same thing, devised by Mr. Brunton, of Leeds, England. This head is put on the market for sale, I think, by the Dental Manufacturing Company, of Great Britain, with that same idea, only it contains natural teeth in Mellott's metal, which are then set in the jaw, and each student having a set of teeth in that way, which he puts up and articulates, and when it comes his turn to operate they are set into the lower jaw, while with other appliances just the same as Dr. Brown spoke of. The head is strapped to the head rest of the chair, if I remember correctly. It seems to be a very nice device, but the price is away beyond anything. I think they asked in the neighborhood of £5 for each one of them. I thought at that time, if they were only reasonable in price, of making these rubber tooth forms that we have here so that they might fit into the jaw, upper and lower, of that head made by Mr. Brunton. Some of the gentlemen here, of course, have seen it; they will understand how it might be done.

Dr. H. B. Tileston, Louisville, Ky.: I want to ask if by setting these teeth in flexible rubber and then applying these mechanical arrangements for regulating them, you can simulate the movements that you will obtain by the application of that same force on the natural teeth. If not, I do not see any advantage in the flexible rubber over the use of plaster of paris casts.

Dr. Byram: I will demonstrate that. Here I have four different appliances for doing different things, and I will show that they will do those things.

Dr. Brown: For fear somebody might think that I was claiming to be the originator of the idea, I wish to state that Dr. Carpenter was the gentleman who gave me the suggestion. I have never seen it applied except as we apply it. There is no expense to it except the rubber dam and the fastening that is necessary to make the articulator firm to the bench at which the student works. That, of course, is a simple matter.

Dr. George E. Hunt, Indianapolis, Ind.: My knowledge of orthodontia is just about on a level with my knowledge of Hebrew, so I have nothing to say on that subject, but there is one thing that has not been discussed yet, and that is the application of these models to the teaching of operative dentistry. I see quite a number of such teachers here before me, so I want to tell you some nice

things that can be done with these models. All of you have, no doubt, commenced a talk on the application of the rubber dam, or of cervical clamps, and found your class all inspired with the simultaneous and instantaneous desire to go to sleep. Anything so commonplace as that is of no interest to them; because they have seen it done once or twice, they believe they know more about it than the man in front of them; but if you have one of those tooth forms with which to demonstrate these things, in the hope that you will make a mistake in the demonstration, they will watch you very closely. So I adjust the rubber dam on the tooth form before the class. I also apply the several different sorts of clamps on the model. I illustrate the removal of salivary calculus and the various methods of separating the teeth. The simplest and most common methods of approved procedure can be better impressed upon the student by the use of one of these tooth forms than by the most eloquent flights of oratory that you are able to bring forth. These tooth forms ought to be passed around here. Dr. Tileston don't know the great advantage of them. I have learned a great deal about orthodontia myself in inspecting these models.

Dr. Byram: Here is one which has two floss wedges, a wooden wedge and an elastic wedge. Here is one with an appliance on. You can see how it has been moved labially, showing the rubber through. Here is one with a mechanical spreader; these teeth were in actual contact when it was placed. Here are some demonstrating the use of cervical appliances. I have three different appliances here—simply brought them to illustrate. I came up hurriedly from my room and left my wrenches, but I can show you later that by moving these nuts you can see by the rubber how the teeth have changed. You will see that this labial protrusion was quite prominent when the appliance was placed on it, it has been drawn in. Here is one that had a labial protrusion as well as a restricted arch, and the arch has been widened by the appliance.

Dr. Hart J. Goslee: I do not like to see this subject passed without taking occasion to agree with the sentiments expressed by Dr. Webster in that it is not possible for a teacher to dissociate technics and principles in his teaching, if he wishes to serve his own and the best interests of his students. The minute you do dissociate them you make a veritable machine of the student in his technic work.

I know that this will not coincide with the views of many of my

ood friends here, because Dr. Hoff and I had a little discussion a ouple of years ago upon that same subject, but I am quite confident aat personally I would not be as successful a teacher in my line of 'ork unless I did associate the two as I went along.

I want to say a word of commendation with regard to these nost excellent models, both for myself and for Dr. C. S. Case, of 'hicago, who regrets that he is unable to be present. Dr. Case is very nuch taken up with these models, in their application especially to the eaching of orthodontia, and requested me to say to Dr. Byram and › this association that he thought it was the greatest step we had et made in the teaching of orthodontia, because of the fact that the nodels could be made placing the teeth in them in the relation we nd in common irregularities, so that the various typical appliances ould be constructed and adjusted and the application of force and s effects noticed. Of course, you do not have the exact conditions ou do in the mouth, but you more nearly approach them than you an in any other possible way.

I believe one of the most valuable things we can add to the aching of technic work is to have the conditions under which the ork is done as near the natural condition as possible.

I want to commend the paper and the models Dr. Byram has esented most heartily, and will say incidentally that I have figured it a little scheme which will enable me, I believe, to produce a set typical teeth to be used in this work very easily, without much cpense, and have them almost anatomically correct, and I am going promise to construct a set in a very short time and submit them to achers in this line.

Dr. H. C. Kenyon, Cleveland, Ohio: I wish to heartily second e remarks of Dr. Goslee as just made in regard to separating the aching of the principles and the technique entirely. I do not underand from the remarks that they have made that Dr. Webster or Dr. oslee would expect that the technic teachers should take the burn off the shoulders of the head of the department whose work is demonstrating; but it is not long since I was a student myself id I remember very distinctly that my mind was in a mood, when vas being taught to make an appliance in the laboratory, to receive me instruction concerning the principles that were involved; and I lieve that if you will teach the student why he is doing the work d give him some of the principles at that time which perhaps operly belong to the didactic teacher, they will become more

permanently fixed in his mind than if given at any other time. I believe there is no other time at which he will receive this instruction so well and remember it so long. And it ought to be a great advantage to the didactic teacher to have had this done before the student comes before him in the lecture room.

Now another thing that I wish to speak of is in regard to the use of these rubber forms. I find that there are a great many more men using these forms than I supposed there were; but I suppose there are quite a number of schools yet that are not using them and have perhaps not seen the advantage of it. We are not using them in our school, but we hope to use them in the future. Some of the gentlemen present have learned a great many items in the making of them; and I should like to ask Dr. Webster or Dr. Byram if there is anything in print, any description, if they have written anything for any of the magazines describing the details of preparing these rubber forms?

Dr. Byram: It comes out in another paper.

Dr. Kenyon: I am glad to know that, for it will be of very great value to have the detail of the work of preparing these models given to us.

Dr. D. M. Cattell: I wish to set myself right—at the same time I do not propose to take back anything I have said. When we teach instrument technics, when we teach the students the making of instruments we do not go into detail and tell them at the time they are making instruments for manual training, for technic purposes, the different forms of cavities that a particular instrument may be worked in. We teach a great many things in the technic laboratory and yet not touch on the greater principles, that the technic work when completed may be passed on and worked into the theory and practice of the principle. I feel that I have Professor J. Liberty Tadd back of me in this idea, a man whom some look up to very highly. It is the finger first. Now, in regard to what Dr. Patterson brought out so boldly: I am not a logician, but I did not suppose it was necessary to have to explain that certain *mechanical* principles had to be recognized in the making of an instrument. I was talking of those great principles underlying practical orthodontia. As technical teachers, when the student first comes into the department of orthodontia technics we do not expect to go into the etiology of irregularities and the principles underlying articulation, and that certain influences will direct teeth in certain

directions so that they keep on moving and get in a wrong position in time; we do not wish to touch upon the principles of moving those teeth. The principles involved in the stretching of the process, and in bending the process and holding it there until nature takes hold and finishes the work; those are the principles that I speak of. It was not that where we turn a screw to the right that it will shorten a bolt, or that we make a cylinder and put a bar through that and a traction screw on one end it will pull two things together that that bar is attached to. I am not talking about those principles; those are simple mechanical principles that should have been learned in the high school. It was the physiological and pathological principles that I understand the paper involves, that he must teach the chair of orthodontia in the technic laboratory, and that I object to, and I have J. Liberty Tadd to stand back of me.

It is the idea that what belongs to the professor in the chair of orthodontia should be taught in the *technic laboratory* that I object to.

Again let me hint to you that the teachings of Professor Tadd will bear me out in the view of the method that should be followed.

DR. BROPHY: I just want to say that the great lesson learned in this extremely interesting discussion is that those of us who are in favor of extending the course of instruction to four years have had sufficient evidence to-day, that such a course is absolutely necessary, in order that our students may have time to learn all about this subject as well as other subjects taught in our dental colleges. The course must go to four years. There is enough in this course, gentlemen, to take up the time of a student two years if he did nothing else, and how can we expect to teach all that is before us in the brief period of three years?

DR. J. Q. BYRAM: I am certain that I was misconstrued in the paper, both by Dr. Grant and Dr. Cattell. The one object I had in view was to keep from making a machine of the student. Dr. Grant fears that there is that tendency by my work. Now, the whole idea in my work is to get as near to the natural conditions as we can, and by so doing relieve the student from the monotony of working on a plaster of paris cast where his work produces no results. We give him something better to work on, and I do not believe that is making a machine of the man. It is lifting him a stage higher.

If any of you doubt that I can do what I have claimed in this

paper, if you will come to me later, I will prove it to you. And another thing, about the carving. It is a very good plan to allow the freshman student to carve his teeth, but now I am introducing these models in junior and senior work. I am introducing it in the junior year for orthodontia as well as for crown work, and in the senior year for crown and bridge work. Now, I believe that the time spent in carving teeth either is or can be better spent somewhere else, and for that reason I suggest we have a better method of producing these teeth.

With reference to the remarks of my friend Cattell I must say I was really surprised. I believe there is something wrong with him. I haven't seen him for a couple of years, but it seems to me he talks rather different from the way he did the last time I saw him. If I have to teach technics in our school and be a parrot, I want to quit to-day. When you take the individuality out of a teacher how can you expect him to arouse individuality in his students? If I am simply to follow my chief professors and do what they tell me to do, or not advance a stage, I want to quit teaching. I want to teach as I want to teach. If I see things that I think are good, I am going to teach those things. I don't care whether those fellows want me to teach it or not.

A MEMBER: You are a kind of anarchist now—you want to be the whole thing.

DR. BYRAM: Not at all. As an illustration, my friend Dr. Hunt has operative dentistry. When I teach that part of the technic work I teach it as I think it ought to be taught. Of course, we teach together, but Dr. Hunt does not say to me that I shall teach this or I shall teach that with regard to operative technic. No man can teach anything unless he teaches principles along with his work. Now, in orthodontia you may show plaster casts, and tell your students that these appliances will do certain things, and produce some impressions, but if you will attach the appliance to one of these tooth forms and demonstrate to him the effect it will have on the tooth, he will get a far better idea and be more deeply impressed.

TEACHING OF MATERIA MEDICA AND THERAPEUTICS —HOW AND HOW MUCH.

By A. H. Peck, M. D., D. D. S., Chicago.

This subject is, I presume, rated by the majority of teachers in dentistry, and certainly by the vast majority of students of dentistry, as the driest and most uninteresting of the entire college curriculum. Why this is so, I cannot tell. I can only leave you, who are especially interested in this work, to draw the inference. As for me, I would not exchange my position as teacher of materia medica and therapeutics for that of any other in the list of instructors. This work is anything but dry and uninteresting, as I find it. I see in this field opportunities for original research, for a broadening of one's mind, for an extension of one's knowledge, for a general rounding of one's mental capabilities and character, as are found in very few, if any, of the other departments of our college work. And surely the individual who is unable, in the light of such possibilities, to present his work to the students in such a way as to command at the very outset, and to hold throughout, their respect and interest, is certainly not the kind of individual referred to by the gentleman who said, "Poets are born, not made." For this saying applies just as truthfully to the teacher as it does to the poet.

One of the first and most important questions to be considered in a paper of this character is, just how far should we, as teachers of dental students, carry our pupils in this great field—materia medica and therapeutics? Are we justified in being content to teach them just enough to enable them to treat locally, reasonably well and with a respectable degree of success, the various pathological conditions about the mouth? Or should it be our aim to so instruct them that they will at once be able to recognize and intelligently prescribe for the various systemic disorders that are constantly aggravating the local pathological manifestations; and, indeed, many of which latter are only indexes to the systemic disorders? My answer is most emphatically in favor of the latter course. Please do not understand from this declaration that I would have

the dental student subjected to as extended a course in materia medica as is required of the medical student. However, I am strongly inclined to the belief that this phase of the question should only be qualified by the unfortunate condition invariably imposed upon us, namely, lack of time. Surely, no one can deny that three years of six, seven or eight months each is insufficient time for the student to become thoroughly learned in all the branches now included in our curriculum; consequently it only remains for the work in some of the departments to be cut down as much as possible, and perhaps chief among these is materia medica and therapeutics.

Nothing grieves me more than to hear, as we frequently do, from the older members of the profession, the leaders, those to whom we are accustomed to look for guidance and inspiration, this sentiment, that it is a mere waste of time to teach the dental student more materia medica than is necessary to enable him to treat, reasonably well, the local manifestations of trouble about the mouth.

What would you think of a man enjoying a lucrative practice in a large city like Chicago, or elsewhere, for that matter, merely treating with local remedies the local manifestations in the mouth of a case of syphilis, and never even thinking that this disease calls for systemic treatment, to say nothing about possessing the knowledge to prescribe for it? More than one case like this has come to light.

The very logic of medicine lies in one's ability to recognize the primary action of drugs upon the various organs and through the great systems of the body, the secondary action upon other organs, and in this manner having an indirect but important bearing upon the local pathological manifestations. Thus is one enabled to note the parallelisms existing between the action of drugs and the pathological conditions in disease—a very fascinating study indeed.

Let it be understood, then, that we favor, first, the teaching of those drugs with which the student will come in contact daily in his practice, such as the antiseptics, disinfectants, germicides, escharotics, counter-irritants, styptics and local stimulants.

Next in importance is a thorough knowledge of at least the standard remedies that may be indicated for the alleviation of such systemic disorders as may in any way aggravate or effect the local diseases or pathological manifestations under treatment; then, a thorough knowledge of the circulatory stimulants and depressants; the respiratory stimulants and depressants; the nerve stimulants and

depressants, is essential. The hæmostatics, diluents, antiphlogistics, cannot be passed by with only a superficial consideration.

Then the most important of those agents which assist to the performance of better work by the digestive, assimilative and eliminative organs—the last comprising the sudorifics, diuretics and cathartics. Local and systemic antidotal treatment is of the utmost importance, and the intelligent prescribing of these medicines must never be neglected.

Two important questions now present: How much regarding these various agents shall we teach? And how best may we teach it? In answer to the first question, I will say we cannot teach too much about them. For example, in considering laxatives, while I would teach the principles governing catharsis thoroughly, I deem it unnecessary that dental students be familiarized with the entire list of remedies in this division, but with the principal ones he should be as familiar as should the general practitioner. The same may be said with even greater force of circulatory and respiratory stimulation. I cannot emphasize too strongly the necessity of being thoroughly familiar with the principal agents or means in these two divisions. The exigencies that sometimes arise while administering anæsthetics, either general or local, constitute an argument that should convince all of the soundness of the above statement.

This naturally leads to the thought that one should be familiar with the various signs, symptoms and indications of a failing heart or of failing respiration. The latter, in comparison, is easily detected, hence the more stress should be placed upon the former.

The pulse, when properly understood, is a reliable index to the condition and action of the heart. I deem it a necessary qualification of the practicing dentist to be able to recognize, through the medium of the pulse, serious diseased conditions of the heart. There can be little doubt that failure on the part of dentists to recognize these conditions through the medium of the pulse is responsible for many serious results, especially in the field of anæsthesia.

Our students should be thoroughly learned in this particular line of symptomatology. Let them be taught what intermittence, irregularity, compressibility and dicrotism of the pulse mean. And especially the characteristics of the pulse and their meaning in actual lesions of the heart. Let them understand that if the pulse is quick, sharp, thready, shot-like in its manifestations the patient is likely suffering from aortic regurgitation or is in a highly tense

nervous condition, and should be dismissed at once lest seriou
consequences result.

Familiarity with the various manifestations of the pulse an
their meaning as to the condition of the heart and nervous syster
seems such an important matter to me that I could not forego
brief reference to it.

It is true dental students should be well grounded in the phar
macology, source, constituents, physical characteristics and proper
ties, physiological action—and this, too, in its broadest applicatio
therapeutic value—this being perhaps the most important of al
and dosage, when indicated, of all the various agents to be con
sidered.

An individual consideration of these agents or groups of agent
however desirable, is out of the question in the time allotted to th
paper.

In answer to the second question, How best may we teach this
I will reply that no one rule or set of rules can be followed su
cessfully by all. As indicated above, teachers as well as poets a
born, not made, and each one will find it necessary to follow th
guidance of his own personal capabilities and characteristics.

No method of teaching can be more effective than that whic
renders the work of study a real pleasure to the student, and sure
no other can be more pleasing and satisfactory to the teacher. O
year ago I conceived the idea of having a student prepare a pap
on a subject pertinent to the department. A number of other st
dents were to be selected to discuss the subject, and were expected
prepare themselves for this purpose. Occasionally during the ter
an hour was to be given to the class for the reading and discussi
of these papers.

When other members of the faculty were told of the plan,
were agreed that it would be excellent work if successful. Son
offered encouragement, while others were so pessimistic in the
views as to express it as their opinion that failure would resu
Never having given much prominence to that sort of a turn in lif
affairs, I determined to make the work a success.

A good student, and one whom the balance of the members
the class respected, was selected to prepare the first paper. Five
six others were selected to discuss it. An hour was set apart f
the reading and the discussion of the paper. It was noted duri
the days intervening that these students were in the library at

unoccupied hours, looking up the literature—not only these, but many other members of the class. They were making thorough work of the preparation. And suffice it to say that the exercise was a grand success. The entire class entered heartily into the spirit of the work, and no such thing as failure was to be thought of for a moment.

Several such exercises were held during the term, and I can truthfully say that nothing in my college teaching has afforded me more genuine pleasure or has resulted in more real benefit to the class than has this work.

In my individual work I find the recitation plan of inestimable value, the source of the drugs, their physical characteristics and properties, their chemistry and dosage being almost exclusively taught after this plan. The physiological and therapeutic action of the agents is taught by lectures and by demonstration. However, ofttimes I find the recitation method peculiarly adapted to this division of the work also. We should strive to make our teaching in these two phases of our work just as interesting to our students and as thorough as possible. It is of the utmost importance that we be able to select the proper drug for a certain form of disease. Blundering in this respect is inexcusable, and often results in the most serious consequences. And to understand clearly just how these agents are affecting the various organs through which they are passing on their disease-healing mission is important and necessary to an intelligent use of them.

Soon after assuming the duties of this chair in college work I became especially impressed with the many shortcomings of our various text-books. Indeed, any one who has taken the trouble to look into this question will agree with me when I say that one only has to consult another author than the one that does not suit him to find teaching to suit his own particular fancy, so at variance are the statements of the many different authors pertaining to these various questions in materia medica and therapeutics.

Their lack of harmony as to the relative potency of the various antiseptics and germicides, and their almost total lack of any consideration as to what special agent, under certain conditions of irritation, inflammation, sepsis, or otherwise, would be more desirable to use than another, especially impressed me. I consider it of the utmost importance that students and practitioners shall become possessed of knowledge that is accurate regarding especially

the essential oils and other agents we are daily using. We should know their relative value or potency as antiseptics, deodorants and germicides. When we select an agent to place, perchance, in the root-canal of a tooth, it is important that we be familiar with its relative ability to perform the work required of it. Not only this but I consider it equally important that we should know the action of these drugs on the soft tissue with which they may come in contact. The antiseptics and germicides are poisonous to the vegetabl cell. They are used in our work to inhibit the development of an to destroy the germs of disease. Many of them are, as well, poisonous to the animal cell. No one will question the great value of bein able to select an agent for a certain case that will destroy the germ present, render the parts aseptic, and at the same time will remai harmless in contact with the soft tissues. Ofttimes it is desirab that an antiseptic or a germicide be used that is also stimulatin to the diseased tissues, causing them to yield more readily to th healing influence of the drug. Again, it may be desirable to us one of these agents that imparts a depressing effect upon the so parts. How are we to make these selections with judgment an certainty without an accurate knowledge of their action when co fined in contact with soft tissue?

That I might have something definite to work upon; that could feel, when I went before my class and made certain stat ments in this connection, that I could verify those statements actual demonstration, I have adopted the following plan of teachi these phases of the subject:

During each term a thorough and complete series of tests made in the bacteriological laboratory and before the class to det mine the exact relative value of these agents as antiseptics a germicides. Also an exhaustive series of experiments has be conducted on soft tissue, both animal and human, while in both pathological and normal state, to determine which are irritati stimulating or depressing, that we may make our selections special use with wisdom and certainty.

I believe the same individual who teaches therapeutics shou teach special pathology. The two fields are so closely co-related t it is impossible for a teacher to give a comprehensive course instruction in the one without trespassing more or less freely on t other. Since special pathology has been assigned to me in conn tion with therapeutics, I find I am able to present the work i

nuch more interesting manner than I otherwise could do. The stu- ents unquestionably gain a clearer and more satisfactory under- tanding of the various diseased conditions, their pathology and herapeutics, than was formerly possible.

Throughout this brief paper I have hinted at the value of object eaching. I wish now to emphasize this method as strongly as nay be. No one can deny that more thorough and satisfactory ork can be done by object teaching and actual demonstration, here the nature of the work admits of it, than is possible through ne medium of lectures. Suppose it is our purpose to teach the lass the effect of a certain drug upon the various organisms, and or purposes of illustration we will consider a cardiac and respira- ory stimulant. We go before the class, and in language that is mple, plain and cannot be misunderstood, tell them the manner in hich the drug affects the circulatory system and the organs of espiration. That they act directly upon the nerve centers in the edulla and through the medium of the vaso-motor system of nerves imulate the muscles of the heart to greater activity, thus increasing ne force and frequency of the pulse; and that they act, through ne medium of the circulation of the blood, upon the respiratory rgans, stimulating them to greater activity, thus deepening and ngthening the inhalations. Again, a suitable animal is provided, aced upon the table in appropriate manner, is anæsthetized that shall not suffer pain, then with the knife and appropriate appara- is these internal organs under consideration are exposed to actual ew; the students see them in operation performing their natural nctions. Now the stimulating agents are administered and the udents see their effect upon these organs. In turn they are taken the laboratory and required to make the demonstration them- lves. Do I hear any one ask which method of teaching will make ne profounder impression on the student's mind? Personally I n see no comparison. The simple pleasing word picture as resented by the "successful" lecturer makes but a passing impres- on on the mind of the average student. This cannot be called nowledge—only transient information. The actual demonstration hich he has made and observed makes a deep and lasting impres- on on his mind and imparts to him knowledge that is his own, nd is permanent.

We do not even think of instructing students in anatomy purely lecturing to them on the subject. The institution to-day that

would advocate that would be laughed to scorn. No; we take th student to the dissecting room and there teach the subject by actua demonstration. What would the teaching of chemistry amount t without the laboratory? And the same in regard to the teaching o metallurgy. It is unnecessary for me to follow this line of illustra tion farther.

It seems to me the statement that object teaching in all branche and departments of our college curriculum which admit of it is th only truly effective method to be employed. We must work int this manner of teaching more and more if we desire to make th best return for the favor and patronage of students. I confidentl hope and expect in the near future to see a general move towar laboratory methods along this line in college work.

DISCUSSION.

DR. JAMES TRUMAN: I am so much in harmony with the maj portion of the paper of Dr. Peck that I feel somewhat at a loss to di cuss the subject except in a few commendatory words.

All true teachers must agree with him that the subject of mater medica may be made the least interesting in the curriculum, or may be made one of the most valuable. This all depends upon t teacher. Many of us may recall the early student experiences wh the mere memorizing of the various drugs was the principal pa of the study and the miserable hours spent over the effort is not t least of the unpleasant experiences connected with the studen work.

The idea which the essayist endeavors to enforce that the stu should be made broad enough to include in its therapeutics system conditions, is not one that will be generally accepted. In a gene way this should be taught, but until dental students have receiv a thorough medical education, in connection with the dental curr ulum, this does not seem to be possible, nor, under present con tions, would it be proper. There is a positive dividing line betwe the practice of dentistry and medicine, which, to overstep, mean conflict between the two professions. It is certainly true that t teacher of materia medica should give in a general way inform tion in regard to the "circulatory stimulants and depressants, respiratory stimulants and depressants, the nerve stimulants a depressants, etc.," but I cannot agree with the paper that it nec sarily follows that the dental student should treat a failing heart

syphilis. The time is altogether too short and the dental student has too much to ingather into his brain, to permit a sufficient knowledge to warrant the practice, presupposing it to be a proper course to pursue. The teacher of materia medica and therapeutics has not the time for this, and that which he does give is simply partial culture and superficial knowledge is always a dangerous knowledge.

We are met in discussing this part of the subject with the much considered topic, must students be medically educated to practice dentistry? This is not the place to enlarge upon this, but the idea of the essayist, if practically carried out, must lead directly to the one conclusion, that the degree of doctor of medicine must be the one degree of the future. It is surmised that very few of us are prepared for this.

The essayist's plan of having the students prepare papers and then discuss them is an excellent idea, but it is to my mind impracticable with very large classes. As nearly all dental colleges now have student dental societies connected with them it would seem very appropriate that this should be delegated to these bodies.

The recitation plan, and by this is understood a thorough examination of the students at every lecture, must be accepted as the most important part of the work. It is the only way this subject can be made interesting and at the same time be thoroughly taught. The teacher must do the work that the text books specially fail to do. These books are necessary, but the teacher that depends on them has not the true conception of what is needed in the instruction of this branch.

I fully endorse the idea that materia medica should be combined with special pathology, and, for this reason, would take it out of the first year, where it is generally found, and place it in the second. The two subjects then can be more appropriately combined.

Thus far I am in general agreement with the interesting paper, but must part company with the essayist when he advocates the demonstration of the drug effects on living animals. My experience as a student, and subsequent observations, confirm the conclusions that if such experiments have any value they are confined solely to the operator. It is impossible for the occupants of the benches to see the result, and they must accept the word of the teacher. The effect of these operations upon young men is demoralizing. They

come to regard animals as their legitimate prey, and the natural brutality and destructiveness is fostered and encouraged. If vivisection is of value, it must be limited to the discovery of the cause of disease and the proper therapeutic measures to meet it. To make it part of every lecture to determine well known facts, is, to my mind, a violation of all the best feelings of our higher nature. It is, therefore, with extreme regret, as I view it, that the essayist advocates this as an important portion of the dental curriculum and of the teaching of materia medica of which, in my judgment, it forms no part.

No allusion is made to the study of pharmacy in connection with materia medica. In my opinion this should come in the curriculum after a theoretical study of the subject, the year following. This would give one year to the theoretical and one to the practical.

The attempt of some teachers of materia medica, and apparently advocated by the essayist, to extend the subject to include all drugs directly or remotely connected with dentistry, seems an error of judgment. A large percentage of the materia medica of to-day is made of agents that have become obsolete, and to study them is waste of time both to the teacher and student. The need of th hour is the use of agents in harmony with present medical knowledge and directly applicable to the treatment of pathological conditions met with in dentistry, and in accord with the advanced conceptions of disease.

It is evident that with the constantly increasing demands upon the dental curriculum, there should be an active effort to bring about a lengthening of the time. The schools cannot teach dentistry and medicine in three years, and, as things are at present, dentistry is suffering to an extent that promises to make the student of the future a sort of hybrid, unable to practice properly either branch of the healing art.

Dr. John I. Hart: I am very glad to have had the opportunity of reading Dr. Peck's paper, and I am heartily in accord with his ideas.

In a paper read before the Eighth District Dental Society of the State of New York, in April, 1899, I said: "I firmly believe when students are prepared to study dentistry—and I mean preparation in its broadest sense—that the time will have come when they will take their M. D. with all that that means, and finally take their D. D. S." Everything that has transpired since that time ha

ıded to confirm my impression. Our work is too important, : necessity for thorough diagnosis and treatment too apparent · our men to be but partially cultured. The only obstacle to rough teaching in this field is the lack of time, and if a sufficient mber of teachers agree with me in that respect we can correct t difficulty in the Faculties Association.

In my judgment there is even a greater necessity for a four years' ırse to-day than existed when the change was made from two three years. What would become of our co-workers in architure if they were satisfied to teach now as they did a decade ago? e artistic has not suffered, but the essentially practical engineering ınch has been extended. We cannot afford to let our practical rk suffer because our theoretical foundation is broadened. A ;h preliminary standard, supplemented by broad and thorough lege education, will cause the next generation of dentists to be :orded the full measure of respect they will deserve.

Dr. S. W. Foster, of Atlanta, Ga.: I am very much pleased have seen this paper, and I have listened to its reading. We ree with the essayist, that this is one of the hardest, and, we ght say, driest subjects our college faculties have to teach. There s been sufficient said to-day as to the method of the successful cher. In our experience we must know that any man who empts to teach who cannot devise means and methods whereby : student may become interested, and in a measure enthused in particular branch, that teacher is a failure, and the college :ulty should select another man for that place.

The next question asked, as to how far or how much we should ıch. That is a question, to my mind, as it applies to materia :dica and therapeutics, that is only limited by the time regulation our curriculum. I believe of all the branches taught this is e of the most important. We must admit that. It is the crowning d the rounding, as it were, of every student's professional ability; fills out and gives to him his true profession; it is the blending, : might say, of chemistry, physiology and pathology. And, as matter of fact, we cannot eliminate materia medica and therautics from our course of instruction while we throw into it more these other underlying fundamental branches. Therefore, I say ıt we should add to this all that we can which our time curriculum ows. Of course teaching, especially the most important branches, referred to by our essayist. This question, then, might naturally

be asked, how far should we prescribe? We virtually agree wi
Dr. Truman in his discussion on that point. We will, therefore, n
attempt to discuss that.

The essayist says that the teacher of materia medica and ther
peutics should teach special pathology. Dr. Webster has said, t
afternoon, in his discussion, "When a man is capacitated to tea
one thing, he should be able to teach all things," or words to t
effect. He recognizes the fact that no one man can teach all
branches as are taught in the study of dentistry. But that le
to this thought, as we are here, gentlemen, to discuss how to tea
In conversation with our estimable friend, Dr. Black, to-day, a
as he has stated at previous times, it is his custom to meet w
his demonstrators and discuss the methods of teaching in his scho
once a week. I believe that that is a valuable suggestion, as
applies to the teaching faculty. I believe that the teacher
materia medica and therapeutics, the teacher of pathology and
teacher of chemistry should know absolutely what the other is doi
with regard to his particular branch. There should be a co-operat
work in that respect. If we teach successfully the fullness of
profession, we must have co-operation, and to get that we must ha
an interchange of thought; and the faculty which does not co
together and discuss their methods of teaching particular branche
compelled, in a measure, to have greater or less confusion amo
the students. We all do not see alike, but if we understand e
other before we go before our classes, we can in a measure k
a harmonious feeling in same, and, after all, that is the real succ
in keeping a school together, in my opinion.

The question is asked how best to teach. I cannot agree with
essayist, as Dr. Truman has said, in regard to making practi
demonstrations upon living animals. I cannot conceive of the i
of any one getting a full instruction in that respect. I do beli
that the student should know the pharmacology of the drugs wh
he should handle and will handle in the practice of dentistry, a
to this extent, in our school, beginning with this year only (
idea conceived), we are having our dental students go into
pharmaceutical laboratory and discuss with the demonstrator in t
respect the pharmacology of the drugs which he will use. My gr
trouble in endeavoring to teach materia medica is teaching the s
dent the individuality of the drug, and the dose equivalent. N
all you teachers who attempt to teach this branch, no doubt rea

same thing, and for this reason—to overcome this—we have empted to throw into this work a little of this pharmaceutical perimentation, and I find that it acts favorably.

Another form, of course, we understand object lessons to be one the best, as the essayist has stated. In our work we have enavored to drill the students in prescription writing. The essayist s been having a certain number of the class write essays and scuss them. We have been having three or four or five or six the students to write prescriptions for certain pathological conions. These prescriptions are brought before the teacher and the ss, and then the relative value of each prescription discussed as it plies to the particular pathological lesion for which it was inded. And I must say that I am particularly impressed with this thod of drawing out, and making the student think with regard the therapeutic application of drugs. They begin, then, to study se drugs, which are compatible and incompatible—and we all ow that there are a great many practitioners to-day, practicing America, who could not write successfully a prescription for ny conditions. This practice of prescription writing I consider be one of the best that I have so far adopted in teaching this rticular branch.

DR. GEO. E. HUNT, Indianapolis, Ind.: It is a privilege to be owed to discuss this excellent paper of Dr. Peck's. The subjects materia medica and therapeutics have not received their full asure of attention in dental colleges. One reason for this has en cited by Dr. Peck—the lack of a suitable text-book. I menned this fact a year ago in this body, and so far as I know, no ort is being made to remedy the deficiency. None of the present rks on the subject are adequate. Even granting that the mat- presented is good—and that is a pretty liberal grant—the plans all the works on dental therapeutics that I now call to mind are en to severe criticism. Clifford's book consists of questions and swers—an abominable method for any kind of work. Gorgas' ntal Medicine is so ingeniously disarranged that I defy any casual er to find any particular information without referring to the lex. In all of the others the desired information is scattered rough several hundred pages of text pertaining to pathology, or erative dentistry, and is unavailable without much trouble and ne being spent in the endeavor. An up-to-date text-book, with the st part devoted to general considerations, the second part to drugs,

arranged alphabetically by their common names, and the thi
to brief treatises on the treatment of various diseases af
manner of Hare's Therapeutics, would be a boon to both stude
practitioners.

I would treat of drugs as follows: Head the drug, for ir
aconite. Then the first paragraph would read "aconite (ac
U. S. P.) is the tuberous root of the aconitum napellus,
indigenous," etc. Only a few lines need be devoted to the
tion and methods of preparation of the drug. Then woul
the "physiological action," followed by the "therapeutics,
lastly, would come the "administration," unless the dru
capable of producing untoward effects, in which case that
come last. Under "administration" the various preparations,
and nonofficial, with their dosage, would appear. All fad
peutics should be eliminated and there should not be a supe
word in the book from cover to cover. Such a work is much

The essayist's attitude in regard to the amount of the
be presented can only be criticised on the score that it d
go far enough. It is my theory that the scientific branch
cluding anatomy, physiology, chemistry, materia medica and
peutics, histology, bacteriology and pathology, should be ta
a dental college fully as completely as in the best medical c
with additional time devoted to their application to the scien
art of dentistry. General materia medica and therapeutics
should be taught with the same thoroughness in the den
lege as it is in the medical college, and its special application
practice of dentistry should be elaborated. I am not one of
however, that believe the dentist is competent to treat s
disorders, nor do I believe it is his province to do so. Such
tions are the result of misinformation. The better knowledge
tains of the practice of medicine the more unreasonable thos
ments appear. The general practice of medicine is rapidly sep
into the practice of specialties. Educated physicians apprec
impossibility of any one person having a sufficiently compre
knowledge of the human body in health and disease, to g
best results in the treatment of all ailments. In our large
the general practitioner is rapidly becoming limited to the
diseases of which fever is the most prominent symptom, and
lesions, and the tendency is to specialize in these. If this
of the men who devote all of their time to the practice of m

s folly to assert that the practitioner of dentistry, whose opporities to prescribe systemic treatment are so rare, should feel led upon to prescribe for constitutional disorders except in the st obvious and trivial matters. I do not mean that the dentist uld not feel free to prescribe a dose of magnesium sulphate or enacetin, if it is indicated, but I do mean that if the condition the mouth indicates gastric or enteric disorders the dentist should mptly direct the patient to one who is better qualified by conual contact with these disorders to conduct the case intelligently l successfully. The study of these subjects by the dental student simply to enlarge his information, round out his education, and ble him to recognize the necessity for treatment. The otologist l oculist study obstetrics, but in a case of labor, they would be as ch at sea as any dento-medical graduate. A more important nt than even a good text-book is a good teacher. Dr. Peck has ranced to a position as a teacher of these subjects that few of our n attain. Our dental college teachers should be men who devote or practically all, of their time to college work. The hour spent ore the class does not begin to measure the extent of the teacher's ors. To properly prepare for each hour in the class room reres several hours of outside work. If this institution can teach teachers how to teach it will have done a great work.

The value of object teaching in the class room, and of laboratory rk, cannot be overestimated. At our meeting in Philadelphia year we discussed the value of the recitation system quite existively. In those subjects for which there are standard textoks the recitation system is of great value. As I stated at that e, the fundamental subjects of anatomy, physiology and chemy may be well taught by the recitation system, but I personally ld not recommend any existing work on operative dentistry to be d in the manner that Gray or Morris' Anatomy, or Kirke's Physigy may be used. I do not see how Dr. Peck can use the recitation tem in his teaching. He tells us himself that none of the exist- text-books are fit to use.

I am pleased to have Dr. Peck report that his method of having student prepare a paper, and others discuss it, was a success. d he asked my opinion regarding such a method I would have dicted a failure. It is worthy of a trial.

Dr. J. D. Patterson: Mr. President, the hour is late, and I ow you all want to go. I had written out a few remarks to

make, and I was going to say many things I shall not now, b Dr. Truman covered nearly all the points, and I agree wit in his criticism; so I shall occupy a very short time. It seems unfortunate that this subject is discussed here from a medico- standpoint (Dr. Peck is a graduate in medicine), inste from the standpoint of a doctor of dental surgery on that account he merges into a line of argument I do not think, in our present condition, is so very va to us. I will pass very briefly the points I want to speak In regard to the D. D. S. writing prescriptions, it is again law in many states for any one who has not an M. D. deg write prescriptions. Lawyers who have had experience in prudence say that there is no question, should the point ar suit for malpractice and damages, that it would be decide the dentist has no right to write prescriptions for the internal istration of drugs. The board of health will not give you a to practice medicine in the state of Missouri, where I reside the degree of D. D. S. You have no right, then, to wri scriptions for the internal administration of drugs. I mysel studied materia medica and therapeutics in the medical class with the medical students, and I believe that this broad kno should be our possession, yet I most emphatically disagree it is recommended that the doctor of dental surgery shall pr for the internal administration of drugs. We should reli keep away from that. It arouses so much antagonism, in th place, with the medical profession, that we should on that a only let it severely alone. There comes to my office a perso needs a treatment internally for a condition of which I see syn in the mouth. They go at once to their physician, with my in tions as to what I think is required. I will not give a presc for a simple case in therapeutics even. It is the physician's b to attend to it—let him attend to it, it is not ours. If y an M. D., you have a right, under the law, but even an when he is practicing exclusively in dentistry, should not giv scriptions for the administration of drugs. Turn that over t physician. It seems to me that is pre-eminently the proper to do.

"What would you think," Dr. Peck says, "of a man enjo lucrative practice in a large city like Chicago, or elsewhere, giving local remedies in a case of syphilis?" Does he m dentist? He must be talking of practicing medicine. If a

scribed administration of the medicine himself, he would be doing most improper thing he could do, in my opinion.

The doctor speaks of the necessity, especially in the field of esthetics, in being able to determine from the pulse the condition the heart. I beg to say that the condition of the heart as noted he pulse throb is not in any way a reliable indication; and when re are serious lesions of the heart, there must be auscultation percussion; there must be markings of special instruments. The se alone is a very insufficient and inferior indication. In order to able to do that a course of clinical medicine is absolutely neces- y. We have not the time for that.

In the administration of anæsthetics the physician should always present. Never do I administer an anæsthetic without the pres- e of a physician. While I know what remedies to use, and I w, perhaps, as well as some physicians that come in my office, that matter is a thing that we must leave in their hands. There st be, as Dr. Truman says, a firm dividing line between medi- e and dentistry, and we must obey that very closely—that's my nion.

I want to add my word to what Dr. Truman and one other aker, in discussing, said in regard to vivisection. Vivisection, ur day and generation, should, in my opinion, be confined to the oratories—biological laboratories, especially instituted for experi- ntal purposes. Vivisection, in our day, I believe, is legitimately fined to finding out the results in the prosecution of a knowledge erum therapy. That is being done every day, being done to-night, he biological laboratories. Vivisection, it seems to me, should be fined there. The very experiment which Dr. Peck speaks about, sthetizing the animal so that it should suffer no pain, would be y imperfect. Let vivisection alone! Let vivisection alone in tal colleges. And do not introduce it, I beg of you, unless you t your dental colleges mobbed. These experiments that he ke about, and all the experiments that the dental student would d to instruct him, to make an object lesson, have again and again n described to us. If the dental student should not have com- n sense enough to understand, when he reads the perfect descrip- of the demonstration, then he has no business in our classes. knowledge must be forced into him through stabbing an inno- t animal, then I don't want him as a student. Why repeat such eriments. I say no, no, not at all. I am proud of the dental

profession, but I confess I would not be proud of the denta fession which had in it vivisectors for the purpose of object merely.

I thank you very kindly, and, in making any remarks have made, Mr. Chairman, I do not mean to reflect on an You are all my friends. You know I am in earnest in what I may make mistakes. You know the old story of the ma always traveled straight and never made mistakes became s lonely that he passed away. So I make mistakes, and perha do. But I do think Dr. Peck, in advising the teaching of st who are to receive the degree of D. D. S. to prescribe i remedies, has made a glaring mistake, and also in advisi object lesson by vivisection.

DR. G. V. BLACK: I would like to say a few words jus some of these lines, and as a preface I may say that we a to disagree, and to discuss our disagreements. I want to re some statements that have been made with regard to this ma vivisection, and perhaps with regard to the matter of pres drugs, and some other things.

We all value the lives of animals. We value the lives more. We value the health of men more than we value th of animals. Now I appreciate the motive of avoiding pain mals. I appreciate the motive of avoiding the destruction mals, I think, as sharply as any one here; yet, if I can, by d ing a comparatively useless animal's life, impress a lesso my class, I should say sacrifice that animal. I am not afra the dental school will be mobbed. I would not ruthlessly an out the impressment of a lesson, sacrifice an animal; but in t anæsthesia I would not hesitate to sacrifice an animal, and I not feel that I had properly impressed the lesson of the of anæsthesia upon my class if I had not destroyed the more than one animal before that class with anæsthetics.

A MEMBER: That is not vivisection.

DR. BLACK: That is practically vivisection. That is w mean—we use it for our purpose and destroy the life of that That is vivisection, no matter what else we do. We may do other things with the animal. If I take a frog and expose i and show the peculiarities of the circulation of blood in th for the purpose of impressing the lesson on my class, have a wrong thing? Certainly not. We even go so far as to

uman subject for a similar purpose, with an effect that is good. nly a short time ago one of our pupils came to me and showed s arm and said: "Doctor, I think there was a mistake in putting is drug on my arm. It hasn't had the effect that it has had the arms of the other boys,"—for a number had applied the me drug, and a number had applied another drug and another ug. They were from Dr. Peck's class. "Cassia has been apied here and I have no blister." He had evidently been afraid at he would have a very sore arm, and had taken it off and looked it, and had finally taken it off before the time prescribed. I id, "Let me see it to-morrow." On the morrow he had a crop cassia pustules, and he was showing it to the others, and the hers were showing theirs, and they were in groups, discussing e effects of the drug, and what it would do if used in this and at position. I tell you, gentlemen, you cannot impress a lesson ith words in so interesting a way as it was expressed by these periments, using the human subject. Of course, this thing must done with great care and judgment, even upon the animals. is taught before our classes that vivisection is a serious thing, d it must be done with care; it must be done for a purpose—we ust get value received for the destruction of life. Gentlemen, am in favor of the impressment of lessons, even by vivisection, ien that is necessary, to properly enforce them.

I regret that we cannot all be graduates in medicine. Under the cumstances I know that it is impracticable. I wish we could be. e ought to be. I want to make a remark about the pulse. The n who would know the pulse, and know it well, must have prace in the examination of the pulse in health and disease. If he s had this practice, and has studied it closely, dropping the finger the pulse of his patient will give him an indication—not sufent to tell just what is the matter—but if there is a serious heart ion, it will give him an indication that will put him on his guard. will perhaps drop his ear over the chest to see what that heart ion is, or see how serious it may be; or, perhaps, this impression t has come from the pulse will lead him in another direction. is not a heart lesion proper, but it is something wrong with the vous system of that patient. I would not like to go into a long eration for a patient that comes to me, if when I drop my finger on the radial artery it presents a sharp, quick, feeble pulse, bese the indications show a condition of nervous tension or some-

thing else that renders the patient unfit for the enduranc
long, serious operation. And I regret exceedingly that th
ditions do not give the opportunity for teaching dental st
to recognize these indications which the pulse, properly s
would give them. It requires a bedside practice, a hospita
tice, or a practice in surgery, or a practice in general medi
enable one to recognize quickly and easily these conditions
pulse that give warning of danger.

Then, again, our patients are often kept too long in the
and a condition of exhaustion of the nervous system will be r
by the pulse. We ought to be able to note that at once
able to wind up our operation and stop in time to save serious
to the patient, which, I am sorry to say, is not always d
have been guilty, myself, of keeping patients too long.
recognized that, and have recognized the conditions followin
conditions of ill-health that were the direct result of keepi
patient down too long.

Now all of these things call upon us as practicing denti
as practitioners of medicine, to know as much as possible o
things, to teach as much as possible of these things in our
and have as many dentists as possible who may recogniz
things with the touch of the finger, or recognize conditio
will cause them to call a halt and look further, for other sy
showing the condition of patients, that they may not do injury
prescribing of drugs does not belong to the dental prac
except in his own field.

Dr. N. S. Hoff, of Ann Arbor, Mich.: This subject of t
materia medica and therapeutics is one that I am very muc
ested in, and, like Dr. Peck, I have found that it is so
rather an uninteresting subject to teach. Like every one e
has taught this subject, I have experienced the usual vicissit
trying to utilize the material we have in print in the way
books which Dr. Peck and others before have deplored. W
plenty of resources in the way of works on general materia
and splendid resources in the way of general pharmacolog
have also a great deal of material on general therapeutics,
are sadly lacking in a book which will present the sub
dental therapeutics in a systematic way, and it is therapeutic
ultimate end which we desire to obtain in teaching materia
It is not simply the teaching of materia medica of itself

sire to utilize. The subject of materia medica is a very small rt of the work. I spend comparatively little time teaching the ure and doses of drugs. Formerly much time was spent in dis-ssing the materia medica and pharmacy of drugs. We were com-led to learn the history of a drug, where it came from, what it ked like, what preparations were made from it, and what the se was. Further than that, we got very little conception of its plication therapeutically. One can readily believe this a very dry l uninteresting subject to teach in that way. I have turned the ject around and am teaching it from the other standpoint. I ch it largely from the practical or therapeutical standpoint—what want the drugs for, etc. I do not teach pathology directly, but identally I must, of course, refer to the nature of disease and application of the remedies for its treatment. In doing so I urally start at the interesting point—at the chair, or at the bed-e, where the remedy is to be used. I experience here the usual iculty of putting into the hands of my students a proper class k for this purpose, as you all know there is nothing in print t will meet the requirements viewed from this standpoint. I e followed the classification as set forth in Wood's therapeutics. ave experimented with all of the various text-books, beginning first with Ingersoll's little work, at his own suggestion, then gas' Materia Medica, then Potter's Text-book, then Brunton's ge text-book of pharmacology, and then Wood's Therapeutics, ere I found something that I could adapt to the teaching of this ject to dental students, because it not only contains all the eria medica that is essential, but also a pharmacological con-ration of all the essential drugs, and a classification that can be ly well adapted to our needs. While it is rather a heavy text-k to put into the hands of the student, it is the most satisfactory that I know of. Of course, it contains nothing in the way of dental rmacology, except incidentally. It contains nothing on dental apeutics, and this I have been able to supply—not to my satis-ion, but very satisfactorily, at any rate, from our general litera-, from the journals, and from other text-books in therapeutics. hin the last two years Dr. Barrett's little work on pathology and apeutics has given me perhaps as much satisfaction as any-g else. It is not a work that will supply the place of a text-book, as a reference book, a book for suggestion, it has been valuable ny hands. Dr. Burchard's work has also been of great help to me.

While it is more a work on pathology, everything in it well done, the book is so beautifully written, that I have great deal of pleasure and satisfaction in using it. With books, and with reference to classic articles on therapeuti dental pharmacology which have appeared from time to the dental journals, I have been able to secure a course of for class work that has proven tolerably satisfactory. Last presented to my class a course of seventy-five lectures. I d little quizzing, but devoted the entire hour to the lecture, written examinations periodically, to see where the student because I did not have the time for the quizzing. I had hand report made of the lectures, and this report was prin put into book form. All who have had any experience in lectures reported will know that anything done so hastily wi sarily be faulty and incomplete, and contain so many er statements as to make it rather hazardous to attempt to as a text-book. But this was sufficiently accurate so that I am using it as a class book. I have had a sufficient nu copies reprinted by typewriters' stencil, and require each to have a copy of it.

I am not lecturing this year at all, but am quizzing I spend the entire hour quizzing. At the beginning of t my students are seated in the lecture room. We have a a bench, such as is used in the public schools—a desk wi to it—two students can be seated at each desk. The d numbered, so that there is an odd and an even number in e At the beginning of the hour I put two questions on th board, one numbered 1 and the other numbered 2. Odd will write on question 1, and even numbers on question 2. questions are very brief, something they can answer on a of paper not more than four by six inches. I allow from to twenty minutes to answer these questions. Sometimes not get through in twenty minutes. When requiring a lit writing or more thinking I extend the time to possibly a h The men have no chance to communicate with each other, has a different question. It is always a question made the lecture of the day or the day previous—that is, the lect should have had were I giving the lectures in regular order the papers are handed in I give the answer to the question so that each man knows whether he has answered the

perly or not, or I call up some one and develop the proper wer by a quiz. Or I call up a student and read some one of answers and have it criticised. Sometimes I read one of the wers and call for voluntary criticisms. I never read all of the ers, and do not mark them. There are so many of them it ıld be a great task to attempt to read them, but I have in my ate room a lot of nails driven into a board on the wall. I make bligatory for each student to distinctly number and put his name each paper before handing it in. I have a nail for each man's ie, and I stab his paper on the nail for future reference. I shall d some of them some time, and I do read more or less of them. ick out the man of whom I am a little suspicious that he is doing his work properly and read his papers, and if his papers not what I think they should be, I quiz him very often. The lents do not know that I don't look over their papers. They not know but that I do. By this plan every man in the room ects to be quizzed every day. Sometimes the written questions of such a character that I do not do any quizzing during the r, but explain the question and comment on the replies. Somees we spend the whole hour in a discussion of the questions. ay quiz the students or they me. Very often the quiz is directed ne. I get quizzed from all over the room. The students frently ask questions that are quite pertinent. I am often surved at the questions that are asked. Usually, though, I quiz the 1. When I quiz a man I don't quiz him on the exact thing reted in the lecture that he has before him. I don't ask him what se of a drug is that we are discussing, but I say something like : "Yesterday a patient came into my office, and he had a first er molar tooth that had such and such a condition—and it is ndition that the remedy we have under discussion is applicable —I say, "What shall I do for that patient?" By asking a ques- something like that—I do not always put it in just that way,— uently I do—he will start to tell me what to do. Very often vill go back to some other lecture, he will think of something that we have gone over already, or something that has been him by some other instructor in the treatment of another case, ie will bring up a treatment some other teacher has given him, I have not given him at all. I make him tell me why he gives treatment, and I confine him to that particular case and that icular condition. Oftentimes he will not recognize the condi-

tion I have indicated. The first thing is to make him give a
plete and correct diagnosis, and then I tell him to prescri
necessary treatment. Sometimes I do not quiz but one o
men during the half hour. But if I do keep one man on th
all that time, I have the attention of every one in the room-
are all being mentally quizzed if not orally. I get as much
quizzing that man as if I quizzed the entire class. One
avoid giving a whole hour to one man unless the rest of th
is kept interested.

This is only an illustration of another way of teaching,
essayist has stated, by the object method. It brings up the
object which students are dealing with every day, and makes s
impression on them that they say, "I had a case like that on
I want to know about it." I try to make the subject so pr
that they become at once interested in the subject. I have nev
so interesting exercises in my classes before—interesting to
get enthusiastic about it and the students do, too. They c
me after the hour is over and want further information abo
case we have considered. They have had cases like it, o
seen them. Sometimes they want information on other cas
pertinent. I have to refer these until they come up unde
proper classification. It requires a good deal of wit and wis
know which question to answer and which to allow them to a
I have found this one of the most interesting methods I hav
adopted in teaching, and I think it is going to be one of the g
value to my students. I do not know that I shall continue it
than this year, as my text-book may wear out on me. To ca
this kind of class work a proper text-book is essential. Th
dents must have something to study beforehand, so that th
come into the class room with some preparation. I have fou
method of teaching this subject not only one of the greatest i
to me, but it has been of value to me, and I am very sure
helpful and valuable to my students. If any of you become w
your methods and can put into practice this method, I hope y
become interested in it. I think it will take a great deal
tedium out of your work, and make it more interesting no
to yourself, but to your students as well. It permits th
present the subject from their own standpoint—the standpoin
which they are thinking about it. And, best of all, it enab
teacher to accurately find out where the student is and w
knows and wants to know. An immense advantage.

Dr. T. W. Brophy: I was very glad to be present yesterday and hear the paper of Dr. Peck, and I cannot say too much in commendation of it. The teachings of the paper, it seems to me, are sound.

Some of the remarks that were made in discussing it surprised me a little. In fact, they surprised me not a little. I wondered, while some of the gentlemen were speaking, what are the objects of certain chairs of our schools? For instance, why do we have a teacher who engages so much of the time of the students in presenting the subject of materia medica and therapeutics, if it is not for the purpose of qualifying these men to make use of the remedies and the methods of procedure that he advocates? If it be true that the dentist should not prescribe remedies, if it be true that he should not make use of the drugs that he is taught to use, and use them in the way that his professor explains, then such a chair should be abolished, because it is not fair to take up the time of young men sitting in the benches and paying their fees for instruction, in teaching them certain departments of science which they, through the law, as was said, cannot employ after they graduate. I hold that every chair, that every department taught in a dental college, is taught in good faith on the part of the teacher and of the institution, and that the student who expects to receive this instruction is qualified to use it after he gets it, and, I repeat, if he cannot, by restriction of the laws of a state, or of the nation in which he lives, use what he has learned, then the chair should be abolished. I hold that a man who receives instruction in the administration of remedies or in the performance of surgical operations or anything else in any of our dental colleges, has the right to make use of it, and if he makes mistakes he is amenable to the laws of the state for malpractice. It is not a question of possessing the degree of M. D. at all, that has nothing whatever to do with it. In England the surgeons have not those degrees in all cases. They have their qualifications, however, as surgeons. They practice surgery; they do it under the laws, and if they make mistakes they are punished according to the laws. The laws of our states have chartered our institutions to go on and teach certain branches, and if they teach those branches the laws of the state will protect the man who goes out to make use of his knowledge. There is a mistaken idea, it seems to me, of what the degree of doctor of medicine empowers a man to do who possesses it.

A Member: You mean doctor of dentistry.

Dr. Brophy: I meant exactly what I said. The degr
doctor of medicine, what does it empower a man to do? W
any one assume for one moment—I would perhaps better rel
little experience I had in Philadelphia a few days ago wher
Kirk was discussing with me this very question. He said o
the most distinguished members of the medical faculty told
about eight or ten years ago, that the degree of doctor of dental
gery was an evidence of a partial culture only, or a partial educ
being so—I will use the expression—being so short-sighted
believe that the degree of M. D. meant a full culture. Now
not think there is any man who has a thorough knowled
what the course of instruction in medicine really is who
state that a man who bears the degree of M. D. is qualified to
up and intelligently practice all of the departments of med
Is it not true that the man who devotes himself to the trea
of the eye and the ear naturally feels that his knowled
cutaneous diseases is not very sound? Would he, then, pr
to treat cutaneous diseases on a par with a man who devotes
self specially to that branch of medicine? No, sir! He wou
exactly as we do—and in this I agree with Dr. Patterson—he
put his patient in the hands of a man having under treatment
day to day those suffering from the kind of malady affectin
patient. For instance, if a man were suffering with a specific d
—syphilis, for instance—we might treat him and treat him pe
as well as could be; but we do not need to do that. Nor
need to take up and attempt to practice gynecology; we would
our patients in the hands of some one devoting himself to the
ment of that class of disease.

The curriculum of our dental schools has broadened, and
broadening and including other branches of learning. W
qualified to prescribe remedies. We must not be told that we
no right to administer anæsthetics. Who is to say that the
fession that brought to humanity that great boon, anæsthesia, s
not have the right to use it? Practically, if they were to do
they would deprive us of our birthright. We have a right t
it, but we must know, if we use it, how to use it, and under
conditions to use it. We must know how to make a diagno
any malady that may confront us. The man who would mak
of ether in his practice without a knowledge of, for ins
albuminuria, or any of the renal diseases, would be groping

dark. A man who would do that might be punished according to law for not observing the precautions that are necessary in the interest of his patient. The man who would administer chloroform to one that has a weak heart, who has an intermitting pulse, or who has at times syncope coming on without any cause apparently —any external cause—or a cause due to an internal disease, would be doing wrong. Consequently, we open up here a new field, we open up a branch we are called to add to the curriculum the chair of physical diagnosis; and the time is now come when the department of physical diagnosis must be a part of the dental curriculum; and I do not think the time will be long until we will see every dental college in the country giving careful instruction in the physical signs of disease.

These are thoughts that came to me during the discussion last evening. The discussion was merely a medley of opinions, and while we look upon our work and think of it, and think of how little we are doing now compared with what we are yet to do—those who are to follow us are to do, and when we think of how we have gathered up as much as we have, we look back, and are very proud of our achievements; and yet, when we sit down and reason the matter out carefully, we cannot help but feel that we are doing very little indeed compared with what is to be done.

I cannot agree with one of the speakers of last evening who stated that we should not administer remedies. What is there that is used in medicine that calls for better judgment than the use of anæsthetics? When a patient goes into a collapse during an anæsthetic, the dentist thinks, "Why, I have no right to administer remedies; what am I to do?" If he cannot administer remedies, he must lose his patients, probably. He *must* use remedies, he *must* know how to use them, and to use them with the highest degree of intelligence and according to the best methods.

That is all I have to say. I want to congratulate the association on this paper. Like all the papers of the author, it was a good one, and I hope he will keep it up and stick right to that line of work, so that the schools all over this country will engage in that careful teaching of therapeutics that he has outlined. I hope they will soon come to it, and when they do, our profession will rise in the estimation of all.

I want to say one more word. I know I am talking too long. I am talking mighty near as long as Dr. Hoff did. When I arose

I didn't mean to. I had the good fortune to be present in
at that great congress. There has never been anything said
that in this meeting. I don't know as I will have another c
to speak about it. I want to say to those of you who wer
there that that was the greatest meeting of dentists that the
has ever known. There was more work done there at that m
for the advancement of the dental profession than was ever
before in any meeting, but as the papers come out now, a
see them in the *Dental Cosmos,* if you read them you wil
that there were dentists who were advancing ideas which
revolutionize the practice of medicine. Read, if you please, a
of Dr. Michael's, of Paris, on the examination of the saliva
has accomplished so much from a dental standpoint, an
shown to the satisfaction of those who have been close to hir
by careful examinations of the saliva we are able to make a
nosis of almost any form of disease known, particularly those
ing the general system. The examinations that he has made
convinced those who are familiar with them that the methods t
employs are far superior to those examinations of the urine,
been done heretofore. And by these examinations he is a
detect maladies of the different tissues of the body that is
marvelous. Then the other papers invite your attention.
papers are coming out now in the *Dental Cosmos,* and those
who have not yet read them will be surprised to see the wor
was done in that congress. I hardly know how many years
take through the *Cosmos* to give them all. But it was a
meeting, and when we have the next one we will have on
greater, I have no doubt.

Dr. G. V. Black: I want to say a word that Dr. Brophy
to say. First, I want to call your attention to the work
Michael in Paris, that you may watch the progress of thought
direction, because it is the direction of thought that must neces
as I take it, become prominent in dentistry within a very few
With regard to this matter of the examination of the saliv
only to diagnose general diseases, but it points directly to th
ditions—the physicial conditions—of the cellular elements and
of the body which bring about caries and which bring abo
munity from caries of the teeth; and it was this particular poi
induced Dr. Michael to go into this study, and his study
other diseases in connection with this was simply incidental

study of the conditions in which caries of the teeth occurs and in which immunity to caries of the teeth occurs. He has entered the wedge in the study of the cellular elements and juices of the body with reference to this subject. It will necessarily become prominent within a very few years. We will have to wait, possibly, a number of years for the perfection of this class of study along other lines before we can make it effective in our specialty; but the time is coming, and those who do not follow this, and follow it carefully, will in a few years undoubtedly find themselves behind the times.

DR. BROWN: May I take the liberty again of trying to keep this discussion together? It seems to me that we are talking of two different subjects under one head. I am satisfied that no one here wishes to authorize the dentist to prescribe for general diseases, such as typhoid fever, scarlet fever and various other affections of that kind. Possibly that was what was meant by the gentleman who objected to the dentist giving prescriptions. On the other hand, while the discussion seems to be extreme, I am satisfied no one here can rightfully object to the dentist having the same privilege that the oculist and the aurist and the other specialists have, of giving such remedies as will help the particular cure that he is trying to effect, in his own special field, and without such remedies it seems to me no one can hope to succeed. An inflammation is inflammation, barring certain differences of the tissue, their vessels and nerves, and so on, but practically the principles of inflammation are the same, and I think the remedies that Dr. Peck called attention to, particularly with reference to dentistry and the teaching of dentists, which he desired to emphasize, if I understand his idea, were such as were necessary to be used in almost every inflammation of a serious nature that we have to deal with in dentistry; and it seems to me if we can bring this thing to a point where we can all agree—and I am sure we can, that we will then have accomplished something valuable in this direction.

DR. F. B. NOYES, of Chicago, Ill.: I am tempted to branch off on certain things which, as I take it, do not strictly belong to this institute—mainly the position of dentistry as a profession, and some things in connection with topics presented in the paper: the use of animals as teaching agents. The discussion of the position of dentistry as a profession does not strictly belong to this institution, and the discussion of vivisection as a method does not strictly belong to this institution; but we are concerned with teaching methods, and,

in connection with the discussion of this paper, with teach methods in the presentation of materia medica and therapeu Now as such I wish to speak for just a moment in regard to section. I do not want to call it vivisection, because there horrible suggestions and fantasies created by that word. Ther in the minds of men and women over the country, connected the word vivisection, the idea of strapping an animal down board, muzzling him with gags, and cutting him to pieces w he is alive and sensate. Now, gentlemen, no one here will advo that method in teaching our profession or any other. It may sibly rarely be used for investigation work. It may possibly justified, in rare cases, but nothing of the kind is suggested in paper. On the other hand, how are we to know the mechanism the human body unless we study it? Would any one advocate an engineer is not to study the machine which he has to run, he is not to see that machine in operation? And if we are to t the human mechanism—the vital mechanism—infinitely more c plicated and inter-related, are we not to study that machine a stands still and as it works? Am I not, in the preparation of material for histological work, to kill animals, to remove t organs while the life is still in the organs? The animal feels n ing; the animal knows nothing more—it is as an animal dead, its tissues are still alive, and I want those tissues while they alive, to study. Again, in regard to the phenomena of life: how we to study the phenomena of circulation and respiration, and phenomena that involve mechanisms unless we watch those mec isms? The value of that object teaching I want to emphasize. may describe the phenomena of respiration and the effect of you may show that in models—a thing that has not been sugge perhaps, by constructing rubber models, for circulation—but i way can we produce the impression upon the mind of the stu as he will receive it while watching the thing itself. Agai want to repeat, we may teach him all about respiration, but he not know what it means until he studies it himself—until he serves it himself. He does not properly appreciate it. The de stration to a whole class, which may be in a certain sense imperfe the value of the laboratory method, which has been suggested by doctor, following out, repeating individually what he has see of more value still, but I want to emphasize, especially as a teac method, the object teaching—the observation of the actual th

Dr. A. H. Peck: Mr. President, I am delighted with the reception accorded my paper by the members of this institute. Had every one who spoke upon the subject had nothing but words of commendation I should certainly have felt that my mission here had been a failure, for if there is anything that I do dislike to hear in these meetings, it is nothing but words of praise and commendation for the essayist and the essay.

I was not disappointed when the remarks of Dr. Truman were read in this discussion, for I had talked with him not many months ago on these very subjects, and knew his sentiments in regard to these matters. I expected exactly the discussion from his pen that we listened to. I was somewhat surprised, however, with the extent of the vigor more than anything else, thrown into the remarks of Dr. Patterson. However, I know that Dr. Truman and Dr. Patterson are absolutely sincere in their beliefs in this connection, also in what they do and say, and in that respect they draw out from me nothing but admiration—for I love to see a man of convictions, and a man of sufficient courage to state his convictions. However, I disagree—I cannot help but disagree with the sentiments of these two gentlemen, and with all due respect to them, as one of the last speakers this morning has hinted, this idea of vivisection with any other name, would not appear half so bad as it does when that word is used. I purposely avoided the use of that term, so as to make this work, or this particular part of the demonstrative work in my department, as mild to your sensitive natures as possible. I would not advocate the reckless use of animals in teaching in this department or any other. I would not for anything carry this particular work to such an extent as to imbue the members of the class with a reckless desire, if you please, to appropriate animals to their uses in this particular, and abuse the use of them. I want to say this, that much of the most valuable knowledge I possess in this connection I have gotten through these means, and I believe there is no other method by which we, who are teaching these subjects as I try to teach them, can employ with equal effectiveness to impart knowledge to the members of our classes. I would like to ask those who shrink from the use of an animal for these purposes in the manner which I have advocated, if they found themselves out on the plains, far removed from any settlement and were hungry, would they shrink from the appropriation of an animal to satisfy their hunger? By no means. We all like a nice roast rabbit, or a nice juicy piece

of beefsteak when we are hungry. There is a parallelism in comparison which I shall make, although it may seem to s there is not. Our dental students are before us in the lecture ro they have paid their money and they are giving their time; are hungering after knowledge; they are entitled to the best can impart to them. It is our duty as teachers to employ legitimate means at our command to furnish, in the most impres way, that knowledge for which they are hungering. If I can impart it by the proper use of an animal, I shall continue to do My conscience shall remain untroubled.

I did not intend to advocate that dentists should be expe to prescribe for all systemic disorders that in any way have a b ing on oral diseases or manifestations. I would not attemp do that myself. However, in regard to the remark that Dr. H made in this connection, that when he went out of the opera h with his medical diploma in his hand he felt that he was jus capable of entering into this field of work as was any other m ber of the class, I wish to state, and I state it honestly, that w I walked out of the opera house with my medical diploma, which I had labored hard, I felt that I had only just gotten a s that only the foundation was laid. I have tried, by hard w through the years that have passed since that event to supplen the start which I then had, and I feel to-day that I am in a p tion much better able to prescribe for these general diseases I was at that time. Of course, Dr. Hunt no doubt meant wha said as a joke, but I am glad to use it as an illustration, to d home to you the manner in which we should take hold of t things, and in which we should endeavor always to prosecute th The thought which I wish to impress you with is this: That dentist in treating the local lesions of syphilis, e. g., as manifeste the oral cavity, who is unable to recognize the necessity of syst treatment, and I know there are many like this, that dentist, in estimation, is a failure in the practice of his profession.

Dr. G. E. Hunt: I don't know whether you believe in rheumatic diathesis as a cause for pyorrhoea, but if you do, an patient presents himself to you, do you give the constitutional tr ment yourself?

Dr. Peck: If that is intended personally, I will say th would treat the general conditions myself, and I am treatin number of just such cases at the present time. I would not

press you with the idea that I would expect every practitioner to do these things, but I want every prospective practitioner of dentistry instructed before he leaves the college, so that he will at least be able to recognize the necessity of proper attention being given to the systemic disorders that are constantly aggravating the local manifestations in the mouth. If we can go a step farther, and impart to them the necessary qualifications that they may be able to properly prescribe for such systemic diseases, I say so much the better; and I stand ready to hail the day when dentists shall have this knowledge.

Some one, during the discussion, has said the pulse is not at all times an accurate index of the various lesions to which the heart is subject. Well, who says it is? I will say this, that he who is familiar with the diseases to which the heart is subject, and with the various methods of diagnosis, will find the pulse a much more accurate index to some of the lesions than he who does not possess this knowledge has ever dreamed of. It is my judgment that our students should be well drilled in this line of thought.

THE USE OF THE LANTERN IN TEACHING DEN HISTOLOGY IN ITS RELATIONS TO OPERATIVE DENTISTRY.

By F. B. Noyes, D. D. S., Chicago, Ill.

The discussion of this subject requires at least a brief con ation of the position and importance of histology in the c curriculum, and the methods of teaching it. The importance subject in the curriculum depends upon the attitude taken to the practice of dentistry. If dentistry is regarded as a mech trade, consisting in filling carious cavities in teeth and repl lost organs by artificial substitutes, histology is likely to b garded as having a very small place in its curriculum; but i tistry is a profession whose field is the treatment of the dis of the human mouth, especially caries of the teeth and the tenance of a useful armature for the mastication of food, hist must be considered one of the very foundation stones of its fessional knowledge.

With the development of modern biology all of the pro of physiology have been restated in terms of cell physic and all pathology reduced to cell pathology. The knowled cell structure must then, with the dentist as with the physici the rational basis of treatment of all diseased conditions c tissues. Not only is this true but in mechanical operations the teeth their permanence and success, as well as the rapid their execution, depend very largely upon a minute knowled tooth structure. It is not necessary to insist further upo importance of the subject to the practitioner as an individu the profession as a whole.

It is a principle in biology, now generally accepted, th individual in its development from a single cell repeats the evo of the type from the simplest forms, or ontogeny repeats pl eny; although in the higher forms the development whic quired ages for the type is crowded into a few months or for the individual. Similarly it is a law of the psychologis pedagogist that the mind of the individual in its develo

epeats the development of human thought; only what required ges or centuries to be mastered in the first instance may be passed ver in a few months or years. In this sense knowledge cannot e handed down, but the road to it may be shortened.

A man's work cannot be handed down as something finished nd complete. In order for it to be understood, enough of his work ust be repeated to have his thought become fully intelligible to icceeding thought. But what one man worked perhaps a lifetime establish, may be demonstrable in a week. All of the blind trails, l of the fruitless labors, all of the slowly corrected fallacies are liminated and his work may be repeated and his statements understood with the same meaning in a very short time.

His statements alone cannot be handed down as knowledge, for nless the individual mind passes over the things which first lead those statements they cannot be appreciated or understood. In ther words, they do not become the working property of the mind ntil the individual has developed them for himself, though e road once traveled may be rapidly traversed by those following.

Some of the gravest fallacies of human thought have arisen by is lack of true knowledge. Statements being taken empirically nd made *a priori* basis for deductions where the meanings of the remises are really entirely. changed or misunderstood. Examples f this may be seen again and again in dental literature.

Histology, literally the science of the tissues, is the study of e structural elements of the organism and their arrangement to rm the tissues and organs of the body. It is one of the younger f medical sciences, but has come to be one of the most fundamental modern thought. In the development of medical thought it was ad up to from two directions. The anatomists arrived at the very reshold of modern histology from the analytical study of the body nd its organs, and here they were obliged to wait for the development of the microscope to show to the senses what they had already gically proved must exist. The biologists and pathologists, the udents of life and disease, were led to the cell theory, especially in e study of the causes of disease, but they too were obliged to ait for the development of the microscope. It is true, however, at the development of the knowledge of the cell and cell life was ade by the biologists first and later carried on by the anatomists. ingle cells were known and studied before the tissues were thought f as made up of aggregations of such cells.

But while the development of thought has been from the single cell to aggregations of cells, the study of single cells was preceded by the morphological study of many higher forms of life, their vital functions and the analytical study of the structure of their bodies.

Histology then should be preceded in the course of individual development by the study of living forms; for instance, botany, beginning with the observation of the forms of leaves and stems and flowers; then the analysis and classification of flowers, using a simple microscope or hand magnifier in dissecting and observing the parts. In this way through smaller and smaller forms to the single celled plants and animals of pond and ditch life. The student is first led to observe the forms and structure of living things, the vital properties which distinguish them from inorganic matter, to analyze their structural parts, noting similarities and differences, and by studying smaller and smaller forms of more and more simple structure till the simplest forms of single cells are reached. This is the path which human thought has followed in the development of human knowledge. Then an ascending study begins, taking up the structure of higher forms in terms of their structural elements or cells.

There is perhaps no teacher in a dental school who feels the lack of sufficient preliminary training in our students so much as the professor of histology. He is obliged to jump the natural development as if we were to put a fifteenth century botanist into nineteenth century study of botany.

In view of this general lack of training there is, in my experience, no introductory work to general histology so good as the study of pond and ditch material. Here the student finds comparatively large forms and single cells which are big enough to be seen with the unaided eye. Here, too, he finds cells associated into threads, sheets and masses and so is led up to the formation of tissues.

Here he has an opportunity to study the properties which distinguish living from non-living matter, and may gain his first conception of the mechanism of life.

This as an introduction leads to the study of epithelial tissues, followed by the other elementary tissues, and the study of the relations between cells as centers of activity and their products in formed materials which constitute intercellular substances. The

last part of the course, of greater or less extent, for the study of the relations of these tissues to each other in the formation of organs.

The following of such a course through one year should put the student's knowledge of physiology and the phenomena of life upon the basis of cell structure and cell activity, and prepare him for the closer and more difficult study of the tissues with which he will specially have to deal. The relations between cellular and intercellular elements in the formation of tissues belongs to general histology; that is, the distinctions and relationships between vital and physical, between the active, living protoplasmic elements and the formed materials produced by them. These formed materials are such important elements of the special dental tissues that unless these relationships have been kept in mind in the general work the student will not be in mental condition to understand and interpret his observations.

METHOD.

It would seem unnecessary to argue before this organization the advantages of the laboratory method over other methods in the study of histology.

In histology the student is studying things, minute though they are, and their relations, to form large and more easily observed things. Very few persons possess sufficient imaging power to construct a mental image from word descriptions alone or by the aid of pictures; especially is this true where all the descriptive terms are new and the standards of measurement unknown. To form a true conception of the size of the things studied, is one of the most difficult things in connection with the subject; even by the laboratory method it can only be done by the use and comparison of various powers and by making drawings as accurately as possible to scale.

By the lecture method, illustrated by lantern or chart, the student is apt to think of things in the size of the picture, or in section only. In other words, they may learn a great deal *about* the things studied, but they do not know the *things.* They learn the appearance of sections, but they do not get ideas of structures in their dimensions of space. Even photographs cannot give complete ideas of structure. As has been said, "photographs give

single fields accurately, but it is with the fingers on the fine adjustment screw that we study the structure of a tissue." To one who has so studied the tissue, the photograph may be nearly as good as a view of a microscopic field; but to one who has not such study back of him, they are not capable of giving the ideas of structure. A comparison occurs to me. The moving pictures which are familiar to all are made up of a series of photographs; if seen one at a time they convey no idea of motion, but if seen in rapid succession the motion appears. So single fields give no idea of the third dimension, but by moving the focus the ideas of depth and relation are obtained.

Dental histology is doubly important to the practitioner for a knowledge of the structure of the dental tissue and the surrounding and supporting structures must be not only the rational basis of dental pathology, but the foundation of ease, rapidity and success of operating.

In view of the importance of the subject, the study of dental histology has, in my opinion, been somewhat slighted in the arrangement of dental curricula. In many cases it is not taught as a subject, but something of enamel structure is given in connection with operative technic and operative dentistry, and possibly dental pathology, and so on, in other subjects, individual teachers, giving some instruction in structure as an explanation of their teaching, instead of studying the structures consecutively and connectedly as a foundation for interpretation of dental physiology, pathology, and technic of treatment.

The course in dental histology should take up the subject where dental anatomy and general histology leave it, studying first the arrangement of the dental tissues in the formation of the teeth; then the minute structure of the calcified tissues, beginning with the dentine and cementum, following with the enamel. The hard tissues should be followed by the soft tissues, the pulp, and the surrounding and supporting tissues, gum, periosteum, and peridental membrane. This study of structures should be made in its connection to physiological, pathological and technical bearings.

The uses of the lantern might be treated under two heads: First, as a means of presenting ideas of structure in connection with word descriptions in lectures, and second, as a means of assisting the interpretation of microscopic observation in the laboratory.

STRUCTURAL ELEMENTS OF THE ENAMEL.

The physical properties of the enamel which are of importance o us in the mechanical handling of the tissue are due to the nature ind arrangement of the structural elements. The enamel is not ι homogeneous substance, but is made up of long, slender rods or prisms, sometimes called enamel fibers, which are five or six ided, usually pointed at the ends, and alternately expanded and ontracted in their length. These rods are from 3.4 to 4.5 m. in liameter, and many of them probably extend from the dentine o the surface of the enamel.

These rods are arranged so that the expansion in one rod comes pposite to the expansions of the adjoining rods, and they are inited by a cementing substance which is also composed of inorganic material. While both the rods and cementing substance ire completely calcified, the two substances show marked differences, both chemical and physical. The cementing substance is nore rapidly acted upon by acids and is not as strong as the subtance of the rods. The substances are also of different refracting ndex. In splitting the tissue it separates upon the lines of the ementing substance, not at the center of the rods.

The lantern is able to well convey these ideas of structure. We may show, first, enamel rods as seen isolated by caries and is seen in transverse section, projecting photographs of drawings nade to show the elements diagrammatically, and follow these by photographs of the sections from which the drawings are made. Then we may show the arrangement of the rods and their relation is seen in their longitudinal sections. The expansions and contrictions of the enamel rods and the relation of the rods to each other in the make up of the tissues cause the appearance of striaion, seen in the enamel with comparatively high magnifications. These expansions also record the manner of development of the ndividual rods.

The conspicuous brown bands known as the lines of Ritzeus, tratifications, or incremental lines, are well shown with lower magiifications. They are due to pigment deposited with the inorganic alts and record the development of the enamel cap as a whole. They are of special interest as a record of the growth of the tooth rown and the position and direction of imperfections of structure aused by interrupted nutrition.

If the student's knowledge is obtained from lantern pictures

alone, he fails to get any conception of the size of these elements and their relation to the tissue, as he will handle it in gross, use what means we may to convey ideas of magnification. If, however, he looks at a section of a tissue, places it upon the stage of a microscope and uses successively higher and higher powers until the elements can be seen, draws a few as they appear and figures out from the drawings and the magnification the size of the object and the size of the paper required to draw the entire crown at the same scale, he has gained ideas of structure hardly to be given by lantern pictures alone.

The best means which I have found for conveying ideas of size with the lantern is the use of photographs of a stage micrometer made with the same magnifying power as the photograph of the tissue, using these as a ruler on the screen. In using these it is necessary to start from some known standard, as the millimeter; using first a power low enough to show the entire scale. But this is a great tax upon the imaging power of the students. It is also of great assistance to compare structure to some known or previously studied object, such as a red corpuscle, as a standard.

The relation of the structure to the cutting and manipulating of the tissue may be beautifully shown with the lantern. The cracking and splitting in grinding showing the way the tissue cleaves under cutting instruments. In places where the rods are straight, as on the labial surface of incisors, the tissues will split easily in the direction of the rods; but where the rods are gnarled and twisted about each other it will not split if supported upon sound dentine. The slides show these two conditions, which account for much of the difference of feeling of different specimens of enamel to cutting instruments. The gnarled enamel will not cleave when resting upon sound dentine, but if the dentine is removed from under it, it will break through in an irregular manner.

In the outer part of their length the rods are usually straight and parallel, and the tissue will often cleave to that depth, the rods breaking off where they twist around each other, leaving the inner half of the enamel, which is very hard to cut. This gnarled inner portion is more easily removed by getting a small bur into the dentine and undermining it, tearing up the tissue from within outward, the structural elements being more easily separated in that way.

In cleaving the enamel, the instrument does not enter the tissue,

eparating rod from rod and following their direction, but the sharp dge engages with the surface, penetrating slightly, and then the orce applied at an acute angle to the direction of the rods, assisted y the bevel of the instrument acting as a wedge, breaks the tissue n the lines of least resistance. If the instrument is sharp it penerates slightly, scratching the surface, but if it is dull the edge ests across the ends of many rods and force applied to it may rumble the ends of the rods, but will not split the tissue through o the dentine.

RUCTURAL REQUIREMENTS OF STRENGTH OF ENAMEL WALLS AND MARGINS.

From the characteristics of the tissue we find certain structural r histologic requirements for strength of enamel walls and marins:

1. The enamel must be supported upon sound dentine.
2. All enamel rods forming the wall must have their inner ends esting on sound dentine.
3. The rods forming the cavo-surface angle must be suported by short rods, whose inner ends rest upon sound dentine and hose outer ends abut on the cavity wall, where they will be coved in by the filling material, these acting as a buttress to the ods forming the margin.
4. The cavo-surface angle must be so trimmed or beveled as protect the ends of the rods forming the margin from fracture condensing against them.

The first step in the preparation of an enamel wall is to dermine the direction of the enamel rods and at the same time otain the outline form by cleaving the tissue with a hand instruent (Fig. 1). The inclination of the enamel wall must then be xtended so as to leave the rods forming the cavo-surface angle pported by short rods covered in by filling material (Fig. 2). here this can be done a strong wall is produced; where this nnot be done the rods forming the margin must be supported a few protected rods, by beveling the cavo-surface angle. ig. 3.)

We may show with the lantern the preparation and trimmings of ch enamel walls first in straight and then in curly enamel (Fig. 4).

DIRECTION OF ENAMEL RODS IN THE STRUCTURE OF THE ENAMEL CAP.

In describing the direction of enamel rods I have used three planes as standards to which to refer all angles and have used the centigrade division of the circle because our students are familiar with it from their study of instrumentation.

The planes are, a mesio-disto and a bucco-linguo-axial plane and a horizontal plane. The first two are defined as passing through the crown in the axis of the tooth from mesial to distal or from buccal to lingual, the third as at right angles to the other two. In describing angles enamel rods are always considered as extending from the dentine to the surface and the angle with the standard plane being formed at the dento-enamel junction.

From a study of longitudinal sections of the teeth it is found that in the enamel cap the rods are so arranged as to give the greatest strength to the completed structure, and this arrangement may be likened to an arch, the point of the cusp, cutting edge or marginal ridge being the crest of the arch.

Beginning at the gingival line the rods are inclined six to eight centigrades apically from the horizontal plane. Passing occlusally they reach the horizontal plane at about the junction of the middle and gingival thirds of the crown, or in the gingival half of the middle third. Passing occlusally from here they become more and more inclined toward the occlusal until in the occlusal third they may reach an angle of eighteen to twenty centigrades occlusally from the horizontal plane. Over some portions of the crest of the cusp, incisal edge, or marginal ridge they reach the axial plane, but in these positions they are often very much twisted about each other, forming the strongest possible keystone in the perfect structure. Passing down the central incline of the cusp the rods become again inclined away from the axial plane toward the central pit or groove. This plan of arrangement can be shown in the drawing which has been made from a photograph, but in the photograph the magnification is not great enough to show the rods well. In a mesio-distal section of a bicuspid the rod directions are also shown in the same way and in this section the tissue has cracked in grinding so that the checks show the rod directions.

This arrangement of the enamel rods should be studied in detail for each of the classes of teeth, as the enamel rod directions in different positions should determine the angle of enamel walls

in those positions. As a general statement it may be said that a strong enamel wall is easily obtained where the rods are inclined toward the cavity, while if they are inclined away from the cavity it is often very difficult to make a sufficiently strong wall. This will be shown in the latter part of the paper.

PREPARATION OF ENAMEL WALLS.

We can take only a few typical positions and will begin with an occlusal fissure in a superior bicuspid. This bucco-lingual section (Fig. 5) shows the entire crown and the position of the groove in which caries so often occurs, usually starting at the pits. Showing just the region of the groove we see the direction of the enamel rods and character of the structure (Fig. 6). A small burr is started in at the pit and carried so as to remove the dentine from under the enamel and then open the groove from within outward; the chisel is then applied to the surface and the tissue cleaves in the direction of the rods as shown in the figure. The enamel wall must now be planed down with a sharp chisel or enamel hatchet so as to bring the plane of the enamel wall into the axial plane. Notice the structure of the enamel wall. The rod which forms the cavo-surface angle is supported by a "V" shaped piece made up of shorter rods resting on sound dentine and all supporting the rod which forms the margin, thus making the strongest kind of an enamel wall. This condition is typical of occlusal cavities and is easily obtained where the rods are inclined toward the cavity, as they usually are on the occlusal surfaces. The cavo-surface angle does not require a bevel unless it is called for because of the sharpness of the corner, and the danger of injury to it.

We may take one more occlusal cavity, a fissure in a molar where caries has occurred. The undermined enamel is removed with a chisel, noting the rod direction. It is not necessary to cut away the dentine beyond the point where sound tissue is reached and then the enamel wall would be trimmed so as to leave the buccal wall in the axial plane and the lingual wall inclined in this instance about six centigrades lingually from the axial.

Taking the mesial plate of a bicuspid and preparing a simple proximal cavity in it we have the conditions shown where the rods are inclined away from the cavity. The occlusal dentine wall cut in the horizontal plane and at the junction of the occlusal and middle thirds of the crown, the enamel wall must be inclined

occlusally at least twelve centigrades from the horizontal plane to reach the enamel rod direction. This angle cannot be extended without making the edge of the filling material too thin and the enamel wall is very weak because it has no support from protected rods. The entire mass of enamel from the occlusal margin over the marginal ridge will break out easily.

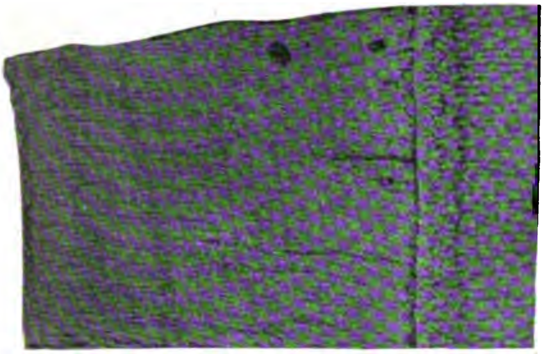
Fig. 7 shows a portion of the buccal plate of a bicuspid which is fairly typical of axial surface enamel in such positions. A portion of the enamel has broken out, showing the way an enamel wall would be cleaved by a chisel. In preparing these walls the tissue must be planed down with a very sharp hand instrument, extending the angle of the enamel wall a little, and then the cavo-surface angle beveled to strengthen the rods forming the margin, as shown.

Fig. 8 shows a buccal cavity in the superior molar, a position in which caries so often occurs. A higher power shows the region of the cavity with the enamel broken out. In the gingival wall the rods have broken across, not following their direction as accurately as usual. The occlusal wall must be extended, inclining it about ten to twelve centigrades occlusally from the horizontal and beveling the cavo-surface angle. The gingival wall inclined about six centigrades apically from the horizontal and beveled.

Finally Fig. 9 shows a lingual pit in a lateral incisor in which caries has progressed, undermining the enamel plates in both directions. This is chopped away till sound dentine is reached, then the occlusal wall inclined ten to twelve centigrades occlusally from the horizontal and the angle beveled. The gingival wall is trimmed into the horizontal plane and beveled slightly. Taking the gingival wall alone the conditions can be better shown.

STRUCTURAL DEFECTS IN RELATION TO THE LINES OF CAVITY MARGINS.

In the development of the enamel cap the tissue is not formed from a single center, but from a number of centers, and the lines at which the formations from the several centers unite produce lines of weakness in the fully formed tissue. These lines produce surface markings upon the crown, the study of which belongs to dental anatomy, but dental histology should study the structure of the tissue in these regions in order to appreciate the conditions which exist when a cavity margin is made to approach a groove



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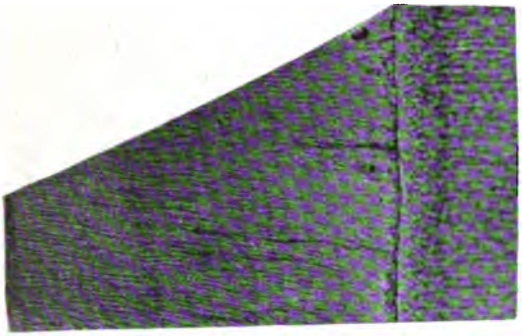

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Figures 4 to 10 appear in January DENTAL REVIEW, 1900.

or fissure which may show no signs of caries. We may show photographs of the crown which show the macroscopic appearance of the enamel defect and the photomicrographs of the sections through the defects, in this way giving some idea of the relation of the two.

Fig. 10 shows a section through a groove. If a cavity wall is left at the position of the line a the rods are inclined away from the cavity, a strong margin cannot be made and a point of liability is left very close to the margin; if, however, the cavity is extended to the line b a strong wall is produced and the point of vulnerability removed.

DISCUSSION.

DR. H. T. SMITH: Mr. President and gentlemen: I hardly know what to say to you about this excellent paper. I had the privilege of reading it coming down on the train, but it has been so elaborated by the impromptu remarks and the excellent pictures, and it covers so vast a field I do not know what to say.

We have had in operation in the Ohio College for a number of years a Colt lantern, such as the doctor is using, and have found it a very useful teaching method. I personally am not a teacher of histology and I should, for that reason, not go into the histological part of the paper at all. But I do know something of the technic of lantern work, and the preparation of slides, having worked at that sort of thing in our own laboratory, and I hoped that the doctor would bring out, in a short way, the technic of the preparation of these slides.

I shall confine what few remarks I have to the position and placing of the lantern, and its use, in a technical way. Our own lantern is placed in a lecture room which is not brilliantly lighted. A screen is located in a comparatively dark corner and the lantern is in position at the lecturer's stand at all times. The pictures are projected on the screen without darkening the room in the least, and the control of the class is not lost in any way. To all of you who have used the lantern, these points would arise as being advantageous to the proper control of the class.

The lantern, I think, is useful just in proportion as it can be used conveniently and quickly by the lecturer at his rostrum. If he is to make a pictorial display of his lecture, he weakens his lecture just that much. If it is to supplement his lecture, if he can supple-

ent his word pictures with pictures on the screen, I think it is the ry greatest aid. I have been a believer, personally, in diagrammatic ıstrations.

I remember particularly in my student days a professor who ıs ambidextrous at the blackboard with his chalk, and the im-essions we got from the pictures he drew, with colored chalk, ere very pleasing indeed; but this lantern work, while it is of the ry greatest assistance to the student, does not help the lecturer becoming a trained illustrator.

I concede, and I think you all will, the importance of dental his-ogy in the dental curriculum, as the doctor has presented it to us, d the great advantage there is in studying it by means of the lan-rn. I know of one dental teacher who has a lantern set up in his vn home, so that he can, while he is at work in his study, try s slides as he makes them. I might mention to you a method of eparing a slide, a diagrammatic slide, quickly, while you are in ur study preparing for a lecture. This is by the use of thin tist's tracing paper of the most translucent type you are able to tain. This piece of tracing paper can be placed over any illustra-on you care to use, tracing it with India ink—ordinary ink will quite well. Such a drawing can be made in a minute and the acing paper placed between two cover glasses, which need not cessarily be even sealed together, but can be put together with ps; the slide then becomes a useful one for your next day's lec-re. These slides are exceedingly useful and quickly prepared, and ey are diagrammatic. You can number them and letter them, as u please, and you can include more or less of the illustration as u please, in your slide.

The points brought out by the doctor in the preparation of cavity ılls and enamel margins I have never seen so beautifully presented. think we might improve some of our ideas of the preparation of amel walls from this time on. At this late hour I have nothing ore to say on the subject, but I should be glad to have the doctor, the time allows, present his methods of preparing the slides that has shown and go a little further into the lantern technic.

Dr. Thos. E. Weeks: The first part of the paper hardly ad-its of discussion—that histology should form one of the founda-on stones of the dental student's education and should have a perma-nt place in the curriculum of every school. How you give it and hen you give it, of course, depend largely upon your environment

and conditions. With us it is given by the teacher of histology in a medical college. However, he is preparing a special course for the students. He uses the lantern in connection with his teaching—not exactly in the same way that Dr. Noyes has outlined, but to quite an extent.

We are endeavoring to follow along the lines suggested by Dr. Noyes as far as possible in the teaching of operative dentistry, applying the student's knowledge of histology to the practical preparation of enamel walls and margins.

The use of the lantern in the laboratory as Dr. Noyes has described, and in the lecture room as Dr. Smith has described, must appeal to every one of you as being very practicable, and being an adjunct that we cannot afford to dispense with, if we need any backing or authority. I might state that in the University of Minnesota there are to my certain knowledge, outside of the medical and dental colleges, eight lanterns in use; they are in biology, botany, mining and mineralogy, they are in chemistry, and they are in mechanics and physics—in fact, in almost all of the branches, excepting the purely classical. They are used by the teachers in all of the scientific departments, they are used and used to a great extent. Every lecture room is fitted, and some of the laboratories are fitted, so that we certainly can draw a lesson from that.

Dr. George W. Cook, of Chicago: It would be useless for me to attempt to add anything to what has already been said by Dr. Noyes. He is so well known as a teacher of histology that I could not possibly add much to a discussion of the subject. We should not lose sight of the fact that Dr. Noyes only uses the lantern as an adjunct to the regular laboratory work. The laboratory technic of histology is one of the best trainings that students get in technic work.

They learn considerable regarding manipulation in the histological laboratory. They learn a great deal in the hardening of tissues; they learn considerable about the use of certain agents. Dr. Noyes makes use of the lantern only as a supplement to his work, and, as we can all see, it is an important thing, because he brings out many points that the student who is not familiar with microscopy at all can see when it is placed before him with the lantern.

The subjects of histology and pathology are often neglected. I did not know until to-night that this was the first paper that had been presented on the subject of histology before this association.

Now, to my mind, if we are going to teach histology or going to each pathology, the technic of the work is just as important as the echnic of some other departments in school work. The basic prin-iple of the sciences of dentistry and medicine is histology. While ve are studying the man in the grosser form; while we are study-ng the aggregate of cells, it is well also to study the cell in minutiæ. The principle underlying the profession of dentistry is that of scien-ific work. What has made the dentistry of to-day has been the vork that has been done in and along scientific lines. There has been great skill brought out, of course, by the technic work, but the ciences, such as histology, pathology, physiology and bacteriology, re the fundamental principles underlying the whole fabric of the nstitution called dentistry. Unless a student is more or less familiar vith the minute structure of the tissues and of the organization of he cell structure he will never make a first-class dentist. He can ave no idea of what will result from the application of drugs. The ody as a whole should be treated as a single cell; it is only a com-nunity of cells, and one cell having been disarranged in any way nay disarrange many cells, and the result is that if he treats the uman body in any particular way to bring it back into its normal ondition, he must treat it as a single cell, because the study of the ingle cell is the basic principle upon which lie the rest of the onditions of which he has got to treat.

As I said a while ago, the study of the sciences has made the rofession. I would like to ask how many men there are in the dental rofession to-day who are scientific teachers—teachers of the ciences, such as histology and pathology? Very few, very few! How many dentists go out from the schools that have anything like knowledge of the fundamental principles of physiology and of his-ology? Talk about treating the human body with all the drugs that here are in the pharmacopœia when you don't know the first prin-iples of the cell—the mechanics of the cell structure itself and he use of the laboratory and the lantern and the microscope is the nly way that you ever reach the scientific treatment of dental caries r any other pathological condition that comes to the dentist for reatment.

Dr. W. E. Walker: I enjoyed the paper and the lantern ex-ibit so thoroughly I can certainly congratulate the gentleman in ucceeding with it as he has. The lantern is used at the University College of Medicine to a great extent, but we have never brought

out its usefulness in the preparation of cavities as has been done here to-night. This has certainly been donc magnificently. I am teaching in the college pathology, therapeutics and pharmacology, and therefore I thoroughly feel that I should emphasize what Dr. Cook has said on the subject of going back to the cell. Our students are taught physiology by medical professors, and histology likewise. The professor of histology tells me that he has more difficulty in getting the dental students interested in histology than is the case with the medical students, who, as a rule, he says, seem to grasp—more than the dental students do—the fact that they are bound to treat the tissues from the cellular standpoint, and while they have studied the histology in the first year, by the time they come to me in the senior year I find that if they ever did know much about histology they have forgotten it, and while I use the lantern slides with them on the screen to good advantage, still I find that I cannot get into their minds a really correct comprehension of what the tissue is, unless I go back with them myself to the histological laboratory, and they cannot comprehend the pathological problems unless they understand the cellular arrangement of the tissue and the fact that they *are* treating *cells only* and never treating tissues. When they treat a tissue they must treat it from the cellular standpoint. It is difficult to get them to *think* in *cellular language*. While the lantern is very useful, I think I can offer an illustration here that will make it clear, as Dr. Noyes has said tonight, that it will never be more than an adjunct to the tissues under the lens of the microscope—for instance, take a set of photographs which have been prepared to illustrate travels in some distant land; a man who has made the trip, and who is familiar with the land can enjoy these photographs and understand them; they will bring back to *his* mind the ideas that he had at the time he saw them. Present them, however, to one who has not *seen* those lands and how inadequate is his conception of what the man *did* see when he was there; so, having studied histology, lantern slides bring us back to our studies under the microscope, but to the student who has not studied with the microscope, it does not give him any more *idea* of what he has *not* seen than the photograph of the traveled land does to him who really did *not* see the object with his own eyes. Those who have tried to study foreign languages know how hard it is to think in the studied language; one is inclined to think in his own language, and so, unless the students have a thorough microscopic grounding

histology and go back to it from time to time, from year to year, ey do not learn really to think in cellular language.

DR. MERRILL, of Birmingham, Ala.: I thank the essayist for e additional illustration that he has given for showing the student hat interest histology is to dentistry, in his setting forth how the iowledge of the direction of the enamel prisms is of advantage in e preparation of the cavities. And I think that all along the line our teaching we will find that it is important to let the student see here what we teach is going to be of advantage to him in his prossional work in his life after he leaves the college.

DR. N. S. HOFF: It seems to me that one advantage of the ntern is the same that we derive from any other method of illusation. It possesses the faculty in a peculiar and somewhat remarkle degree of attracting attention, and attention is one of the most sential features in teaching anything. Anything that will secure ention, anything that will concentrate, if you please, the attenon of the class, as a picture on the wall will do, is of the very eatest value. I can very readily see how it would be of immense vantage to the teacher of operative dentistry in presenting such bjects as have been presented to us to-night, in the preparation of vities, etc. To my mind, the lantern picture has not so much real vantage in teaching histology or bacteriology, for instance, as it s in teaching the subject to which our attention has been called is evening for the reason that looking at a lantern picture is like oking at a photographed picture. When you look at a picture on e screen taken from a microscopic slide, you get only one view it; you do not have the opportunity of focusing the object as unr the microscope, and you are never able to get the depth and the ferent views of the object as you would from looking through e microscopic section with the microscope, where you have the portunity of adjusting it and getting the different views.

In teaching histology from the lantern view of the slide, while rhaps it does not distort the view, it enlarges it so greatly that it ses something of its value. A student perhaps cannot form any nception of the relative sizes of structures as exhibited by a lantern de. He does not know how many times, for instance, that pic-re has been magnified. I don't know that that is a matter of eat importance at any rate, as the matter of relationship is in-itely of more value, but of course we would like to know how big hing is, or how little it is. Everyone wants to know this. We

look at a tall building, or we look at a tall tree, we want to know how tall it is, and similarly if we see something very small we want to know how small it is. We like to weigh things in our minds. If we can get a mental conception of the comparative size of a thing we are able to mentally comprehend it. It is an advantage to see things in as nearly their normal sizes as possible and then to see them under known magnifications. In a lantern exhibit it is not always possible to explain definitely to a class what the difference in magnification may be, and it may be possible that in the teaching of the subject of histology the lantern slide may lose something of value or it may convey impressions that are not just what the teacher would like. If I were teaching the subject of operative dentistry by this method I would expect to have these same difficulties to contend with, but I can see that it is an appliance of very great value in teaching the subject to which it has been applied by the essayist. If I were teaching operative dentistry I should most certainly avail myself of this excellent method of illustrating this subject.

DR. HENRY W. MORGAN, of Nashville, Tenn.: I arise for the purpose of complimenting the essayist of the evening on presenting this paper. I have witnessed many lantern exhibitions and have watched the progress of microscopic work under the hands of late Drs. Atkinson, Abbott, Heitz man Whitman and Dr. Boedecker for many years, but never until this evening have I seen exhibited the practical application of microscopic work to operative dentistry clearly, forcibly, and in a manner that cannot be questioned, but must be accepted by all those who appreciate the difficulties we contend with in the management of the enamel margins.

It emphasizes to my mind one other point—that the teacher of dental histology in dental schools ought to be a dentist, who understands the practical application of microscopic work and histology to operative dentistry. I thank the doctor very heartily for the pleasure he has given me this evening.

A MEMBER: Suppose you come down and tell us, we would rather have dentists in all these chairs.

DR. MORGAN: I believe I am prepared to say yes. The manner in which the doctor has explained the necessity for beveling the cavo surface angle have been beautifully illustrated, and I am satisfied that the association has been highly honored in the presentation of the paper, and I want to congratulate the association on having the first chance at it outside of Chicago.

I wish to state the reason we have not had a paper on histology before is, this association could not go beyond the technic of practical dentistry until last year.

DR. G. V. BLACK: I will not take up time, only to say that this is a field of work I have been immediately interested in, especially how to cut enamel to the best advantage, and how so to shape enamel walls and cavo-surface angles that they will be sufficiently strong. These things have been exceedingly difficult in teaching operative dentistry, and this mode of teaching, I find from practical results, is a great benefit; shortens the work materially, and gives the students a very much more comprehensive idea of the subject. Indeed, they grasp it very much quicker and more perfectly than by any other method of teaching that I have seen. I think a great deal of it.

DR. NOYES: I do not wish to detain you; it is late now; but I feel that perhaps there are others as well as Dr. Smith who would like to have something more in regard to the technic of lantern work. In the first place, in regard to handling the lantern, as an adjunct in lecturing. I very much, personally, prefer to handle the lantern myself. I think that the value of the lantern in class-room work is very largely lost if the lecture room is so arranged that it is necessary to use an assistant. It is impossible for any assistant, no matter how well he is familiar with the slides, or the presentation of the subject, to handle those slides in the way that the lecturer wants them exactly. Aside from that, the lecturer will want to go back to a slide. For instance, in a lecture, I will have a half-dozen slides, or less. My lecture goes on; I use the blackboard, and I use pantomime, or clay or anything else in illustration; I come to a point where I can use the lantern, and I simply throw up the switch, put in the slide and my picture is on the wall. I can use my lantern in a room in which the light is simply prevented from falling directly on the wall on which we are projecting. You see that in this room, with full electric light, I get practically a perfect projection. The lantern stands right beside my lecture table, and I can point out anything in the field, with a pencil at the slide, or I can step to the wall and point it out. When I am through with that illustration I go right along with my lecture; I can then turn to the blackboard or to the clay and use that as an illustration; so, as Dr. Smith has said, the lantern is valuable to the lecturer as an adjunct just in proportion as it is easily handled. Then as you go through your lecture, you want to come back to a certain slide, you know just where it is, you do not

have to talk to an assistant, which would distract the attention of the whole class.

The lantern in our school we use in two different lecture rooms, and in two or three of our laboratories and class rooms. It is constantly used in my laboratory, and for that reason we have had rigged up this sort of a table, that we carry around anywhere in the building, and all that is necessary is to screw the plug into the electric light socket and throw in the switch and it is all connected. It stands in the pit in the lecture hall and projects at a distance of about thirteen or fourteen feet, giving a circle, or a square, of something like eight feet, which is plenty large enough to be seen throughout the room.

In the technic of preparing lantern slides, of course I need not go into the whole photographic problem of the preparation of lantern slides. It may be well to explain, in the enamel illustrations, the preparation of the cavity is made on a photograph of a microscopic section. First a picture is printed from that negative and then the cavity is prepared by cutting out with opaque on the negative, painting the opaque on the glass side. It can be painted on the film side, but it is easier on the glass side, and less danger to the negative, and changing the enamel preparation by the way the opaque is applied. You obtain, in that way, the same effect which you would if you had cut the cavity in the section before it had been ground, but if you had cut it in the section before it had been ground, it would be infinitely more difficult to prepare the sections.

In the use of diagrams, as you notice, the slide I first had on the wall was a diagram which was made by photographing a drawing. You recognize it, probably, as one of the old illustrations. It was made from the india-ink drawing. The drawing was photographed and we obtained a negative, and the lantern slide was printed from the negative in the usual way. Of course that gives the most accurate reproduction of a text-book illustration which we can get, but it requires time to get the negative and make the lantern slide.

With certain photographic tricks we can shorten that time greatly. I often prepare two or three illustrations from our text books in the evening before my lecture, but it takes considerable time—the whole evening, nearly. In reference to the suggestion of Dr. Smith, that is, tracing on thin paper, I have used that and discarded it. I have used, also, tracings on ground glass. I used that at first, but discarded that. You will find that you can get still better

results by simply taking the clear glass and add sugar to your ink. If you add sugar to your ink it will stick to the glass and you can make a tracing directly upon the glass with the ink and have a perfectly clear projection. Another method is to use the clear glass and flow over it then celloidin and let it dry. It will stick to the glass and give you a perfectly clear film. If you are too lazy to do that and are willing to waste the money, buy a dozen lantern slide plates, clear in the hypo, and dry the clear film, then upon that you can draw with water inks, not the insoluble India inks, but the water inks, in colors, as many colors as you may use, which dries in a few minutes. When you are through using it, wash the ink off and dry again, and it is ready for another time. You will find in tracing this way illustrations which you want to use, or diagrams which you want to make, you can do very quickly, very easily, and present them without taking the time to draw on the blackboard, and, in my experience, to very great advantage. If it is, however, an illustration from a text book which I want to reproduce as accurately and perfectly as possible, I photograph it and print it, and you can reproduce on the screen reproductions of illustrations from the text books as perfectly as they appear in the text. It requires just a little practice in the photographic technic. When I began two years ago I had never exposed a plate in my life, I had never seen a plate developed, and I want to say to you, to those of you who fear the photographic technic, it is not as difficult as you might believe, and it abundantly repays your effort.

In regard to the attachment of the microscope for projection, to this lantern, I had always supposed that in order to use direct projection it was absolutely necessary to possess the extremely expensive projection microscopes, which cost, I believe, $300 to $550. Well, it is not. The microscopic projection apparatus which I have, attaching to this lantern, cost only $10 altogether. It consists—I can show you in a moment how much time it takes to change it. You pick up your microscope from the table and turn it over at right angles and I have a board which is made with a socket to set my microscope on, so that when it is set in that socket and turned over it is centered; so that there is no time wasted in adjusting centers. All that is necessary is to put the slide on the stage with the microscope and project it. You can project with that perfectly simple apparatus with a two-thirds objective with perfect ease, and with a sixth objective, with a little greater care. I use occasionally a sixth,

but I use chiefly the two-thirds objective. You get all the colors of the staining, all the perfections and imperfections of the microscopic slide, a very great help in connection with the photographs in laboratory work.

In regard to the application of the instruction to practice, it is in my opinion the salvation of the teacher of a theoretical subject in a dental school, the only thing which enables a man to hold the attention of a class on an abstract subject like histology or materia medica, is to make the students feel and keep them feeling that these abstract subjects are of every-day application in what they are going to do. Our work in histology is covered over in two years—general histology the first year, dental histology the second year—two complete years. Now I find every year men coming in will say: "I had both general and dental histology—I am all through histology, I don't want to take your histology." They are clamoring every year to get out of junior histology. But I find that about Christmas time I don't hear any more about it; they don't say any more about wanting to get out of junior histology. They have discovered, somehow or other, that that subject, which they considered as having nothing to do with the preparation of cavities and the filling of teeth, is really the thing which is of the very greatest importance. I tell my boys every year that the thing which has increased my rapidity of operation and my success of operation more than any one thing since I graduated has been the minute study of the structure of the enamel, and just in proportion as they study, in the operation, and before their operation, they will cut enamel easily and accurately and successfully, and before they get through they feel that, and as soon as they once feel it in regard to one thing in histology, they are willing to take your word a little bit that some of the other things which they did not see the application of really will have some application after a while. It is true of the anatomist. One of the most successful teachers of anatomy told me not long ago that the one way he was able to get men to work in anatomy was to show them at each lecture some place where a knowledge of anatomy had come in point in practice. And he made it a point of his study in every lecture before that class to bring out some case, either in his practice or some other, where his knowledge of anatomy had been of practical value to him as a practitioner. The same thing applies to histology knowledge and the teaching of that subject.

Now, in regard to one other point, I feel that the work on this ubject has just begun. The application of it to the practice of lentistry has just begun. There are, as I might suggest now, a lozen different lines which have not been worked up, in which the tructure is related to the practice, and those things are hungry for nen over the country to become interested enough in them to work hem out.

PRESENTATION OF THE TECHNIC OF CROWN AND BRIDGE WORK, METAL AND PORCELAIN.

By Thomas E. Weeks, D. D. S., Minneapolis, Minn.

In outlining a course in technic, three things should be kept in mind: First, to require the smallest number of pieces which will comprise the fundamental principles underlying the subject. Second, to select such pieces as will appeal to the student as being practical and as having some intrinsic value when completed. Third, to adopt those methods which are simplest and most direct.

Systematic technic teaching in dental colleges has passed the experimental stage, and there seems to be no question as to its value. It now behooves us as teachers to winnow out the chaff, which has been the chief cause of cheapening the article in the minds of the critical, and to leave only the sound kernels which are to furnish food for our children, the students. We must admit that in our earlier efforts we wasted time in repetition, which is seldom of any advantage unless it may be where the clinic is insufficient to provide practical cases. Then only such work is beneficial as will familiarize the student with the qualities and working properties of materials, or aid him in manipulation and construction.

Students usually perform in a perfunctory manner all operations in which they cannot see some direct value or bearing upon those things which they come to the college to learn. This fact should prompt us to select tasks that will be interesting, that do have value, and which appeal to the student as being practical. At the same time we must not lose sight of the necessity for cultivating manual dexterity.

No work should be required which at any stage presents conditions which must be imagined; *all* the conditions must be real. To illustrate: Plates may be made to fit models accurately, but the adapting of plates to the tissues of the mouth cannot be taught on models. Crowns may be perfectly fitted to natural roots mounted in models, but their relation to the surrounding vital tissues as presented in the mouth cannot be illustrated by models. Typical cavity form and the insertion and finishing of the various filling mate-

rials may be practiced upon ivory or vulcanite teeth, but the feeling and behavior of enamel and dentine vitally connected cannot be taught out of the mouth, to say nothing of the conditions which determine the outline of cavities and the shaping of the finished filling.

In a word, such portions of our work as are purely mechanical, that can be carried to perfection independently of vital connection, belong justly to a systematic and sequential technic course, while all portions which are governed or modified by vital relations belong properly to the lecture and recitation method, which, by the way, should be fully illustrated by demonstration. The subject should be carefully analyzed under the two heads of what to teach, and how to teach it. Under the first head should be considered the necessary operations, their relations to the vital, mechanical and æsthetic conditions and the causes of failure. The second head should consider what must be taught by precept and example, and what may be accomplished by practice. This last having been determined, it remains to set such tasks for the student as will best fit him for the performance of the operations in the mouth.

In pursuance of this plan we would consider under the subject of crown and bridge work:

First. Those operations which supply useless or missing natural crowns by artificial ones of metal or porcelain, or a combination of the two substances, attached to healthy roots.

Second. The attachment to the root, the health of the root and surrounding tissues, the relation of the new structure to these, its neighbors and its antagonists.

Third. Contour of the surfaces from the physiological, mechanical and æsthetic standpoints, and the formation of articulate sounds.

Fourth. Occlusion and articulation, that will perform the function of mastication.

Fifth. Proper form, bulk, etc., of posts and ferrules or bands, and the correct preparation of roots.

Sixth. The causes of failure, which include insufficient strength of structure, unwise selection of the kind of crown in a given case, and neglect or ignorance of the principles already enunciated.

Analyzing the subject under the second head, we find that the construction of crowns and bridges is almost entirely a laboratory process, and that by using models, properly articulated, bearing na-

CHART.

	Class. (Anchorage.)		Subclass. (Material and Construction.)
1	Those depending upon a dowel-post in the root for anchorage.	1	All porcelain crowns without ferrule.
		2	All porcelain crowns with ferrule.
		3	Metal and porcelain crowns without ferrule.
		4	Metal and porcelain crowns with ferrule.
2	Those which as caps envelope the stump of a crown and depend upon it for anchorage.	1	All metal shell or jacket crowns.
		2	Metal shell or jacket crowns with porcelain facing.
		3	Porcelain jacket crowns.

ral roots, we may teach in the laboratory the construction of every
riety of crown and dummy; the proper form of posts and fer-
les, and their adaptation to the roots, with proper contour, contact
d occlusion. The other points which relate to vital and artistic
nditions must be taught by other methods. As the number of
owns differing more or less in construction is legion, it is wise
separate them into classes:

First, those based upon anchorage, or manner of attachment.

Second, those based upon materials and construction. (See
art.) No matter what the material or the method of construc-
on, all crowns depend upon either the dowel post or the ferrule, or
combination of both, for their attachment.

As no single material or type of construction is indicated in
ery case, and as each of the seven subdivisions furnish crowns
hich are indicated above every other under certain conditions, a
mplete technic course must include the construction of at least one
each type.

On the model before you is illustrated the course selected by
e author as best fulfilling the conditions. It comprises:

First. A Logan or other ready-made crown without a band—
the right upper central incisor.

Second. A baked porcelain crown without a band, on some
oth.

Third. A Logan or similar crown with band, on right upper
eral.

Fourth. A baked porcelain crown with band, on right upper
spid.

Fifth. A metal and porcelain crown without band, on right
per central.

Sixth. A metal and porcelain crown with band, on left upper
spid.

Seventh. A metal shell crown, on left upper first molar.

Eighth. A metal shell crown with porcelain facing, on right
per second bicuspid.

Ninth. A porcelain jacket crown, on peg-shaped right upper
eral.

Tenth. A metal shell crown with labial face cut out to show
e natural tooth, on right upper cuspid.

Eleventh. A metal and porcelain dummy soldered, for left up-
r first bicuspid.

Twelfth. A metal and porcelain dummy, facing removable, for left upper lateral (resting on gum).

Thirteenth. An all metal dummy, for left upper second bicuspid.

Fourteenth. A metal and porcelain dummy, removable facing, for right upper bicuspid.

Fifteenth. A baked porcelain crown, on right upper second bicuspid.

Sixteenth. A baked porcelain dummy, for right upper first bicuspid.

These several operations when Nos. 6, 7, 11, 12, and 13 are combined in one bridge; Nos. 8, 10 and 14 in another, and Nos. 4, 15 and 16 in a third, give us such a variety as to include all the principles, materials and methods of construction.

Having decided what shall be included in our technic course, that is, what to do, we are ready to determine how to do it.

In the first place, all the students should have models which are alike; to insure this, a number of tin models are prepared, which possess the necessary qualifications. These are issued to the students, who at the same time are provided with the necessary teeth and roots upon which to build the crowns. Thus provided, they make plaster models with the roots in their proper position. These models, with the lower ones, which are properly articulated, are mounted in a Bonwill or other anatomical articulator. This work must be done under the close supervision of an instructor, in order that the models shall be properly constructed, with the natural teeth and roots in their proper positions and relations.

As all the operations require the use of a metal to some extent, it becomes necessary to select a metal which will best meet the requirements. After experimenting with copper, brass and German silver, they have all been discarded in favor of aluminum bronze, which is easily swaged, fuses at a high temperature, consequently is not easily burned, oxidizes less than the other metals, and presents, when polished, a color closely resembling gold.

The one objection is the expense, but as the quantity used is so small, the expense is harldy worth considering. The posts may be made of German silver.

Two grades of silver solder having such difference in the fusing point that the low grade may be fused upon the high grade, are necessary. The high grade is used in the construction of all crowns

d dummies, while the low grade is used for uniting these in the mpleted bridges. In the baked porcelain crowns no metal has en found which takes the place of platinum; on account of the pense it is necessary to make the posts much smaller and the caps ich thinner than would be indicated in practical work. This, of urse, necessitates impressing upon the student the proper size of st and thickness of metal for the cap when used in the mouth. the soldering of this work, a solder of eighty parts of pure gold d twenty parts pure platinum, is used for uniting bands, caps d posts, while pure gold is used for uniting the pins of the facing th the post. This latter is done to avoid the danger of changing e color of the facing under the high degree of heat which is cessary to fuse platinum solder.

In preparing roots for all crowns which use the dowel post, ferle or band, there is a wide divergence in the practice of different erators. However, there are certain principles which must be served. The first is that where the band or ferrule is employed, at portion of the root which extends crownward from the gingival e, must be slightly larger in circumference at the gingival line; e second is that the end of the root should be so formed as to esent a firm seat for the crown; this is true whether there is a nd or not.

In the construction of any porcelain and metal crown, for the anterior teeth, it is desirable that metal should not be apparent the labial surface. To insure this the labial half or third should shortened so that the free border of the gum will cover the band this locality. This is illustrated in the preparation of the cuspid, cisor and bicuspid roots. The first preparation is where it is cessary to supplement the post by retaining some considerable rtion of the linguo-gingival ridge; this may be employed also in etal and porcelain crowns where the lingual surface is contoured th solder, as it results in a saving of solder.

The second form is used where the occlusion is such that the guo-gingival ridge must be sacrificed in order to insure strength this portion of the structure; it is chiefly indicated for the baked rcelain crowns. The preparation for crowns without bands is istrated by these two central incisor roots. The preparation of e labial portion of each is identical; the difference is that in the st the root is so shortened throughout its whole circumference at the joint between crown and root is covered by the free border

of the gum. There are times, however, when it is desirable to expose as much of the joint as is possible under æsthetic laws to the cleansing action of the tongue.

In such cases the second form of preparation is indicated.

It is not the purpose of this paper to discuss the question as to the necessity for devitalizing pulps in all cases where the jacket crown is employed, but so long as many good operators continue to adjust such crowns in selected cases without devitalizing, it is competent to consider one or two rules based upon principles. It is not necessary that the *diameter* of the stump in every aspect should be greater at the gingival line; but it is necessary that the *circumference* should be the greatest at this point. If the mesial and distal walls can be so formed as to show a decided central inclination either the buccal or lingual wall may show a convergence from the central axis. In such cases the opposing wall must be almost or quite parallel with the central axis. With the proper form and construction of the occlusal surface it is not always necessary to remove all of the enamel upon the occlusal surface.

The preparation of the right upper lateral, cuspid and bicuspid and the left upper molar will show such preparation as might under certain favorable condition, dispense with the devitalizing of the pulps. In the construction of dummies there are two types—those which rest with equal pressure upon the gum throughout their whole circumference, and those in which the lingual surface is cut away in such a manner that only the labial or buccal edge of the gingival end comes in contact with the gum. As both forms are employed the course should comprise them both.

As each operation upon the model comprises something of interest, either in principle or construction, we will take them up in regular order. In most of the operations, the steps have been illustrated in detail. The heroic model is a reproduction, enlarged ten times, of the upper model used by the students, and saving the relation to the teeth of the lower model, the work is constructed as in the smaller model. Because of the difficulty in manipulation, the thickness of the metal is less than ten times that of the metal used by the students—that being twenty-eight gauge for caps, shell crowns and dummies, and thirty-six gauge for backings, in all operations employing the bronze. In all other particulars we have striven to observe proportion.

As the central incisors are generally teeth which indicate the

application of a porcelain crown without a band, the right upper central is selected for the first operation.

The crown is cut off to within one millimeter of the gingival line; this gives it a concavity from mesial to distal, and a plane surface from labial to lingual. For the purpose of cheapening the cost of material, an old-fashioned pivot tooth is selected and ground to fit the root. The canal is now enlarged for the reception of the dowel post; when so enlarged, the opening presents an oval form, having its greatest measurement labio-lingually. A post of German silver, having the form of a parallelogram in cross section, is fitted in the enlarged canal.

The projecting end is cut off to the proper length, and made to fit accurately into the recess in the porcelain crown. After fixing the post in the recess with cement, the crown is ready for final adjustment. This crown is fitted to the root in which the preparation permits the joint to be covered by the free border of the gum, and teaches the making of posts and the grinding of crowns to fit the end of roots.

As lateral roots often indicate the use of a ferrule the right lateral has been chosen for the porcelain crown with band. In this case the root is prepared much the same as for any dowel post crown with a band; special care must be taken that the end of the root is so formed that the band cannot under any conditions creep up to impinge upon the tissues at the gingival line; the crown is adapted into the coronal edge of the band by grinding and swaging. The same kind of tooth is used here as for the central, and the post is fixed in the recess in the same manner. This is operation No. 3 and gives the student his first lesson in making and adapting a band to the root. For the same reason which prevailed in the porcelain crown without a band we may select the right upper central incisor for operation No. 5; the metal and porcelain crown without band. This operation consists in burnishing a thin plate of metal cut to the outline of the root, against the end of the root, passing the post which has been previously fitted into the enlarged canal, through a perforation in the center and uniting the two with solder. After being assured that the metal plate fits the root perfectly, the facing is ground to fit, backed properly with metal and fastened to the post. The crown is now completed with high grade solder which unites the facing, plate and post, and completes the lingual contour. In this operation the student learns to properly shape a facing; to

apply a metal backing properly, and to flow solder in sufficient quantity to form contour. He should also be impressed with the necessity of having the metal on lingual surface strong enough to resist all stress, thus protecting the facing from fracture.

In operation No. 6, metal and porcelain crown with band, the method and lesson is the same as in No. 5, after the construction of the cap. Here the student should learn the proper construction of caps for all types of crown where they are employed as a foundation.

Operation No. 7, gold shell crown, teaches the adaptation and shaping of a band of sufficient width to form the axial surfaces of the completed crown; the carving of a model for the occlusal surface, the making of a metallic die or matrix in which the occlusal surface is formed, and the reinforcing of this occlusal surface and uniting of it to the band with solder.

In operation No. 11, metal and porcelain dummy with a so-called self-cleansing lingual surface, teaches that the facing in this case requires a different form from those already adjusted. It also teaches the construction of an occlusal surface and its proper adaptation to the facing, besides giving further facility in the forming of contours with solder. By this time the student has probably learned that it is possible to crack porcelain facings in the soldering process, and will doubtless welcome the instruction given in operation No. 12, where he makes a dummy for the left upper lateral, with the facing riveted to the metal work after the soldering and finishing is complete. He also learns how to construct a dummy whose gingival end shall be accurately adapted to the model. As the several pieces comprising the first bridge are now complete, it remains to assemble them in their proper relations and unite them with low grade solder. When this is accomplished the student should have gained sufficient knowledge and ability to enable him to perform the simpler operations of crown and bridge work. He should at least be fitted to go on with the more advanced operations which are intended to give him greater facility, and show him how the various methods may be adapted to varying conditions.

While the hood crown or shell, having its labial surface cut away to expose the natural tooth, is not often indicated, its proper construction ought to be taught; for by the difficulties in its construction will the student be made aware of its weaknesses, and be better able to select such teeth for the operation as will promise success.

In operation No. 8, the student gets opportunity for further ractice in the construction of a shell crown and learns how to older porcelain without investment. In No. 14 he has opportunity further perfect himself in making a metal and porcelain dummy, nd the adapting of the riveted facing under a little different conitions.

In the completed bridge he has opportunity to correct the miskes of the first one and show progress.

Porcelain Crowns and Bridges.—As there are certain principles nderlying the construction of porcelain work, it seems wise to onsider it apart from the other work. There seems a growing ndency in the profession to use porcelain, so the teaching of its roper construction is indicated in a complete technic course.

The first principle governing construction is that the metal founation or framework should possess sufficient strength to withstand l the stress of mastication.

The second is that the bulk of metal should be so placed and stributed that it will give the greatest possible bulk and strength the porcelain. Third, the attachment of the pins to the metal undation should be as far rootward as possible.

Fourth, all joints must be in perfect apposition and united with solder which will not change under the heat necessary to fuse the rcelain.

Fifth, the utmost cleanliness must be observed in every step of e operation.

Sixth, the body should be of high grade, finely triturated and id in such a manner that it will present a solid homogeneous mass hen fused. If all these rules are observed there is no operation hich fulfills so perfectly the æsthetic requirements, and when we nsider that in porcelain faced metal crowns and dummies, the ns of the facing usually limit the strength of the work and that many cases it is impossible to provide sufficient strength, we will nclude that the porcelain crown will not fail us in point of rength.

In the construction of the crown for the upper cuspid (operan No. 4), there is illustrated, first, the proper preparation of the ot to allow sufficient bulk of body in the linguo-gingival ridge insure strength in this locality.

Second, the proper shaping of the facing and its union with the wel post. In the crown for the right upper bicuspid there is

taught, in addition, how to construct a cap with two posts in such a manner as to support the lingual cusp. In the joining of these two crowns by swinging in a dummy for the first bicuspid space, the proper construction of the framework of a bridge is illustrated. In the construction of the crown without a band for the right upper central (operation No. 2), the method of procedure, saving the cap, is the same as operation No. 4, and gives the student opportunity to learn the manipulation and fusing of the body before he applies the body to complete the bridge.

In presenting this outline of a technic course there is no claim to originality of method and if proper credit has not been accorded the originators it is because the sources are so numerous that it would be difficult to mention them all. The author, however, desires to express his appreciation of all the assistance he has received from many sources. Detail of method has been omitted because it seems unnecessary to enter into details before such an audience, furthermore the object has been to suggest operations illustrating principles rather than to exploit methods.

DISCUSSION.

DR. N. S. HOFF: Dr. Weeks has talked so long on this subject, I have no doubt you are all tired of it, but Prof. Brophy tells me that Dr. Weeks is going to make a present of this model to each of the colleges represented here to-day. I don't want to criticise him too much, for fear he will leave my school out. I have been trying to think of some nice things I could say about it so that I could cheer him up a bit and make him think it is worthy to present. It is certainly a beautiful model; it is the nicest thing of its kind I ever saw, and the most practical.

Without entering into any criticism, if I were disposed to, of the work which he has presented to us, the form of the work, the method of presenting the work to the class, in the class-room, it seems to me that it is so commendable I fear we shall all be dissatisfied until we have possession of these facilities. If we can get it out of Bro. Weeks, it will save us a whole lot of bother and trouble; if we cannot, then we shall have to make it ourselves. We must each have a model like it.

He has mentioned so many things that are perfectly obvious to us that simply the mentioning of them is enough to carry conviction and need no great elaboration.

There are some thoughts in his paper that struck me very forcibly, and one is the thought that whatever we teach in these technic classes should have a practical bearing. Now I think that this is a very important feature—it is not only important in the subject which I tried to talk upon this morning, that is, getting at the student himself; to teach from his standpoint. We all know how often it occurs, particularly with the first year men, how they will come to ask about this, that and the other piece of work they are about to do. "Is this anything I am ever going to use?" or, "Is this a practical thing?" I don't know where they get that notion, that things are not going to be practical that are taught them. It seems to be either their fault or the teachers, I don't know which. If they don't see the direct application of it at once, they do not feel that interest in it that they do if they can be sure that it is to be something they are to utilize by and by. This may come, of course, as a fault of the circumstances which brought them into the study of dentistry as a profession. It is a thing, possibly, sometimes, that we need to educate them out of, but we must take advantage of this fact; it predominates their minds to such an extent that it seems to me we do not do ourselves justice, we do not grasp all the opportunities we have, unless we do take advantage of such conditions. When we have educated them out of such ideas, then we can present more abstract teachings, perhaps. So if we can show them such models as these in an attractive way, just what the thing is to be when it is done, it is a great point gained. If we can by any combination of means or circumstances present to them a form of teaching which commends itself to their minds at this time, it seems to me we have got the advantage of them. We are getting hold of them in their own way, taking them on their own grounds as they are, and we have an opportunity then to appeal most strongly to them.

We must not, however, spend too much time in catering to the student. Some of us may think, possibly, that the sooner we get the student out of that attitude of mind, the sooner we will get into the mind the proper method of doing his work, or the sooner we can make him follow our dictation, the more power we shall have with him. But this, in our experience, is not true. We must adapt ourselves to the material we have and adapt ourselves to our circumstances. And all such things as this are helpful. You cannot describe these different methods to a class so well without an illus-

tration as you can with them. Possibly some of the methods the essayist has advocated do not appeal to all of us, but we can very easily adapt to this model any peculiar method of our own and make the idea ours.

Dr. Weeks recommends the use of high fusing material for the making of experimental crown and bridge work. Now we do not in practice use high fusing material always in making crown and bridge work. We use a great deal of gold—perhaps the large majority of cases made with gold as the metallic substance—we use very little platinum, except in porcelain work. The teeth which we use in making crown and bridge work will not stand the high fusing solder which he advocates, and I think it is very much a question whether brass, after all, is not more nearly similar to gold, so far as the fusing point is concerned, and whether we cannot better teach by using brass in place of this aluminum bronze, because it simulates the material in which the students will work in practice. The fusing points are more nearly similar; the methods of working are more nearly similar. I have never used this aluminum bronze, but the statement that it is used because it has a high fusing point, it seems to me, renders it objectionable for technic purposes. To my mind any one who can use brass in technic work can use gold in practice. We use brass solder in place of silver solder, and brass plate as a basis of all technic work. A solder made of copper, silver and zinc fuses slightly below the fusing point of brass plate, and so near that that it simulates more closely the use of gold solder on gold plate than the platinum or silver solder does on this bronze, and so I think that if we are going to keep up this idea of doing those things that are practical, we must keep as close to the practice as we can. If we cannot use the gold because of its expense, we must use the thing that is most nearly like gold to be consistent. When I want to illustrate the use of platinum I use German silver as a substitute for platinum in technic work. I use copper where I would use pure gold, as a substitute for pure gold, and brass where I would use gold plate.

Dr. Hillyer: Dr. Weeks mentioned that some one has criticised the fact that his model is in one piece. I think it an advantage for the student to be able to assemble his work on one model.

I want to speak of one criticism which I heard in the adjoining room of one particular crown which is placed upon that model; and that is the hood crown. While many of us would not make it in

our own practice, if we could possibly avoid it, there are those who go out from college that are called upon to make that crown, and consequently it becomes necessary that they should be taught that just as much as any other construction.

Dr. Hart J. Goslee: I am very glad indeed to have had the privilege of looking over the paper of the essayist this morning. It was given to me late last evening, and I glanced over it casually during the discussion of the preceding paper, and it is a splendid presentation of the subject of the technics of crown and bridge work, and I should like to have had time to go further into the discussion than I will be enabled to, and even devote, perhaps, as much time to discussing it as Dr. Hoff did to Dr. Peck's paper this morning.

One of the first things that the essayist referred to was that of wasted time in repetition in the teaching of technic work, and I would take exception to it in a general sense from this standpoint, that if we have the time to devote to it, in that allotted for technic work of this nature, we cannot give the students too much, even though they may make two pieces identically the same; because they are benefited by each one, and while I would not advocate by any means that time be wasted in useless repetition the students cannot get too much of it.

They should have a great variety of ideas given them. Dr. Hillyer has referred to the hood or jacket crown, and while we know its application should not be generally practiced, the student should be taught how to make one, because sometimes they are indicated. For instance, in an extensive lower bridge, perhaps extending from the cuspid to the second or possibly even the third molar, I feel that a hood slipper or jacket crown for that cuspid tooth would often be the very best thing that we could possibly put there, because it would be much stronger than if we cut the cuspid clear down to the gum line and put on a dowel crown, especially if there was considerable absorption. So we must teach everything that has any practical bearing. We should condemn it where it should not be used, and teach the student only to utilize it in those places where it is specially and directly indicated.

One of the crowns referred to by the Doctor in his essay, styled the jacket crown, I would criticise. The jacket crown as described is to-day practically obsolete, and to it as much as anything else that I can conceive of just at the present, is due the condemnation

by a great many of the application of porcelain to crown and bridge work. When you slip a thin matrix of platinum over the protruding and projecting end of a tooth it does not leave room enough for porcelain, and never possesses strength enough to be permanent. I have made a great many of them, and seen many made by men distinguished in this line of work, but most often they are failures, because you do not have room enough for the porcelain—and the strength of porcelain increases in proportion to its bulk—so you must cut the tooth down to make room for it. Such a crown might possibly be indicated on teeth where you do not know how long the root may be, or whether you can get a post in it or not, and in such instances should be invariably applied to gold and not porcelain in combination with a facing.

The essayist approves of the construction of the work on plaster models by the students, which I have abandoned entirely, because I feel that to do it successfully the student must have a model that is practically indestructible. Four years ago I presented to this society a little method of combining metal with the plaster model so that you would have a portion of it indestructible. Tin models are made, to be used for taking impressions, shaped as desired for the bridge or crown and an impression in gutta-percha, of the working part of it then taken and filled with fusible alloy or tin, making a metal working portion, then another impression of the entire model in modeling composition is taken into which is placed this metal portion, which is then filled with plaster, and we have a plaster model with the exception of the working part, which is metal and indestructible; which is of advantage, of course, over the plaster, because the student can do all the work he wants without any danger at all of destroying the model on which he is at work.

A very commendable thing which he made reference to in the teaching of crown and bridge work, was the use of anatomical articulators, and I want to say that I believe it is just as essential to construct a bridge upon an anatomical articulator as it is a plate. We do not use these articulators enough. A great many bridges break and fail simply because they do not properly articulate, and do not admit of the lateral movement that we get in the natural articulation.

I criticise, like Dr. Hoff, the use of aluminum bronze and agree with him in that we should teach the students to use a metal as nearly similar to that which they will use in practical work as pos-

sible. Two years ago in presenting a syllabus of prosthetic technics to the committee appointed for the purpose, I suggested and stipulated that brass should invariably be used in the teaching of technic work wherever gold would be indicated practically; that pure copper should be used wherever pure gold would be practically indicated, and German silver where platinum would be indicated, and I believe it is the only method by which we may familiarize the student with the fusing points and characteristics of the metal that he is going to use when he applies them to practical work. Aluminum bronze does very nice work, I have no doubt, but it is harsh and stiff and unlike gold in its working qualities, and I would never have a student construct something of it that would represent something constructed of platinum later on in practical cases.

Another thing the essayist referred to was the use of very thin materials in the construction of porcelain crowns and bridges, because of lessening the expense. Just the minute we begin to teach the student, even to permit him, to use a thin material for technic work, we will lead him to think that probably he can do that in practical cases to cut down the expense; and I believe that we ought to vigorously require him to use a material for his technic work, in thickness as well as in fusing point, that he would have to use for practical work.

The use of platinum solder in single crown work, which the essayist speaks of, is entirely unnecessary and not at all indicated. The point made in favor of platinum solder for porcelain work is this: that it enables you to use a solder which does not fuse or melt at the fusing point of the porcelain in the furnace. If you have perfect contact between the parts, and solder with pure gold and fuse that pure gold perfectly it becomes absorbed by and alloyed with the platinum, and you have a joint that is just as strong as you can possibly get with platinum solder. The trouble is that they use, as a rule, entirely too much pure gold and do not apply heat enough to fuse it down well so that it will flow over the surface and become alloyed with the platinum, with the result that when it is placed in the furnace covered with body, the pure gold then melts and is absorbed, leaving a space, if you please, which invariably causes porosity of the porcelain.

Two contact surfaces of platinum can be soldered with pure gold, placed in the furnace along side of porcelain, and you cannot separate them when taken out of the furnace. The joint is perfectly brazed.

I criticise in a sense the essayist's method of root preparation, for I believe, gentlemen, that one of the greatest mistakes in teaching crown and bridge work is in neglecting the essential requirements of root preparation; for the reason that we know one of the greatest causes of failure in this work is the neglect shown this very subject. Whether it is necessary to devitalize teeth for a shell or telescope crown is not to be considered here, but it is necessary to sacrifice enough of that tooth to properly reduce the dimensions and circumference equal to the cervix. If you do not, you will never have a perfect fit.

Probably if we had some kind of instrument that would go around the neck of a crown after it had been mounted, burnishing it in to the root at all points, then we might negligently treat root preparation. So long as we have not an instrument of that kind, however, we must have the root prepared so that the band will fit, up under and within the free margin of the gum.

Reference was made to the changing of the color of facings in soldering. Even where pure gold is used, there is no occasion at all for the bleaching of facings, and I predict that not one in a hundred will change materially if selected with a knowledge of their capacity for heat. I do not have that trouble myself with the teeth that I now use for porcelain work and have not had for some time. Some teeth will, of course, bleach at the fusing point of pure gold to some extent; but if they bleach there they will in the furnace too, so that they should not be used.

The essayist refers to the two central incisors as being practical indications for the use of crowns without bands; but I differ with him there, because I do not believe that when we find sound tooth structure, there is a tooth in the mouth where the crown without a band is indicated. Most often the indications for a crown without a band are in those cases where, because of extensive decay, you have no chance to band, but certainly not on good healthy sound tooth structure, because of the fact that the band adds such additional stability to the crown (if the root is prepared properly and the crown fitted properly) and the immunity from decay it affords, as well as from a possibility of fracture of the root, demands that we almost invariably place bands upon every tooth that we hope to crown permanently.

I do not think that too much stress can be laid upon the strength of the metal parts in porcelain work, and have treated that subject

in a more or less exhaustive manner in two papers in the last year and a half, one of which has been published in the DENTAL REVIEW, the other of which will be published in the *Cosmos* of next month. The metal construction that I have advocated and taught is almost identical to that which the Doctor describes here—which is very beautifully illustrated, and which will show you that the bridge itself, or even the crown, should possess strength enough in its metal construction, before the porcelain is added, to almost withstand the stress of mastication.

The lingual supports which the doctor has on these models, if you will remember, those projecting spurs, which support the masticating portion, are absolutely indispensable. One of the greatest failures we have had in this line of work in my observation, is the breaking away of that lingual mass of porcelain, because it was not supported, to overcome which I devised these spurs, and you will have failure with your work unless you place them there, or something else that will take the place by preventing cleavage in the stress of mastication.

I think, gentlemen, that as a suggestion of the principles involved in the teaching of the technics of crown and bridge work on the whole, and as a method of illustrating those principles, the essayist has done admirable work, and that this society should give him a vote of thanks for the most excellent presentation of the subject.

THE PRESIDENT: Dr. Weeks, will you kindly close the discussion now?

DR. WEEKS: I know of no better way of closing the subject than to simply veil the model.

CLASS-ROOM METHODS OF TEACHING ORAL SURGERY.

By G. V. I. Brown, A. B., D. D. S., M. D., Milwaukee, Wis.

The successful teacher of oral surgery, as, indeed, of any other branch, whether in a medical school or elsewhere, must depend for success upon order, attention, thought. To have these he must awaken the interest of his pupils, and in order to do this he must be prepared to select for them just so much of the subject as it is essential for them to acquire, to present these facts in such order that their relation to other portions of the subject may be quite clear, and the impression so strong that at least matters of primal importance may remain fixed without confusion in their minds, at the same time more advanced thoughts should be given which will tend to suggest reference to books and other literature with a view to becoming more widely enlightened upon the subject.

The real topic for our discussion is as to the most ready means of approximating this idealistic result, and it would seem as though the following maxims laid down by those for whom pedagogy has been the study of a lifetime, might aid us in this respect.

1. Attention is the condition of knowledge.
2. Mental growth depends upon attention.
3. Memory and perception depend upon attention.
4. Teaching power is determined by the power to secure attention.

It seems to me that if we would learn principles systematically rather than so much, we would have more knowledge at our command. If we could see the thought as developed in any subject just as we should and must see the thought in reading—and not only see the thought in one subject, but be able to follow it through every branch—then our knowledge would be systematic.

The seven laws of teaching (Gregory).

1. Know thoroughly and familiarly whatever you would teach.
2. Gain and keep the attention of your pupils, and excite their interest in the subject.

3. Use language which your pupils fully understand, and clearly explain every new word required.

4. Begin with what is already known and proceed to the unknown by easy and natural steps.

5. Excite the self activities of the pupils, and lead them to discover the truth for themselves.

6. Require pupils to re-state, fully and correctly in their own language, and with their own proofs and illustrations, the truths taught them.

7. Review, review, review, carefully, thoroughly, repeatedly, with fresh consideration and thought.

Nothing is more distressing than to witness a lecturer, manuscript in hand, reading to his audience, unless perhaps it be one who for want of manuscript goes haltingly through, repeating and confusing both himself and his auditors. Between these two extremes of bad illustration of both methods must lie the indication for a proper delivery. In other words, one should neither depend upon a written manuscript nor entirely upon an effort of memory, but should be prepared to speak directly to his listeners with full opportunity for his personal magnetism to keep him *en rapport* with those he desires to impress, able to follow uninterruptedly with his eye the effect of every word, without confinement as to exact phraseology, but ready to change instantly the selection of a word in order that some more striking illustration be used, yet with memoranda for occasional reference to enable him to speak consecutively upon the various divisions of the subject.

Recitational methods are fast supplanting other means of instruction and the results from the standpoint of the acquirement by the student of a limited number of facts certainly seem to justify this change, no longer is it possible for the somewhat picturesque lecturer of a decade ago to adopt the mannerisms of the rostrum once considered such an important feature of medical and dental college instruction, and yet there is perhaps another, little-thought-of, side to this question, for where can a man of high thoughts and firm convictions so deeply imprint the image of his better, more truly ethical self than when as teacher to pupil he speaks of those principles of practice which are at least an echo of all that he would have been, even though not quite what he really is, and without some such uplifting suggestion where is the knowledge of professional feeling to be fostered?

It often seems to be necessary to refer to parts of a subject that properly belongs to another chair, and in this way students are frequently obliged to listen to lectures upon the same subjects from several different professors. This may be avoided in a large measure by reference which will be sufficient to awaken interest without destroying it by repetition, and when in the regular order the subject is reached, much greater benefit will be received by the student and an unnecessary confusion will have been avoided.

The lectures upon inflammation, its etiology and pathology, and treatment, may with considerable advantage be so conducted as to occur at about the same time that the lectures upon operative dentistry are treating of pulpitis and other diseases of the dental pulp. Abscess can follow or precede, with benefit, lectures upon alveolar abscess, pyorrhoea alveolaris and similar affections of the oral tissues which are still within the recognized limits of the course upon operative dentistry, and an added interest will be given to many parts of this subject when properly identified in near relationship to septicæmia, pyæmia, necrosis, caries of bone, and gangrene. The work of the professor of therapeutics can be greatly facilitated by arranging to have his lectures so directed that remedies, the administration of which he is teaching, will be those best applicable to the treatment of diseases which the oral surgeon is describing at about the same period in the course. We have found it extremely satisfactory in our work in the Milwaukee Medical College to have Professor Hill, who teaches therapeutics, give occasional joint lectures with me. By previous arrangement he enters just at the precise moment when I have finished the consideration of etiology, symptomatology and operative treatment, then he follows right on with other treatment, requiring members of the class to go to the blackboard and write prescriptions, subject to discussion and revision by fellow students.

Attention should be called to the importance of a thorough understanding of anatomy, emphasis given to the anatomical relation of associated parts, vessels, nerves, etc., but instead of trying to give a review of the subject the class can be notified that questions concerning the anatomy of the field of operation will be included in all examinations. Students are then obliged to turn back to the pages of their anatomy, closed perhaps with final intent at the end of the second year.

Consideration of surgical cleanliness and aseptic precautions

refers directly to bacteriology. Here, again, time which would be otherwise taken, can be saved, if attention be called to the benefits to be derived from care in this direction, and the danger to be apprehended from pathogenic bacteria, particularly such as have an especially pernicious influence, all of which they must prepare themselves to be informed upon at examination time.

Embryology, histology and pathology can each be treated in the same manner.

Orthodontia can be given an added impetus also, because it is upon the principles taught in the technic and lecture courses upon this subject that the preparation of many of our best and newest splints depend, and deformities of the jaws are concomitant with many diseased conditions calling for our treatment.

Even chemistry is woven into the woof of this surgical garment, through its bearing upon examination of urine, blood, and secretions of those organs which we in common with all other surgeons must look to for indications to determine indications or contra-indications for operation.

Hygiene forms an important part of many subjects, while ethics must be carried like a golden thread throughout the entire length and breadth of the course, always in evidence, ever shining to light toward higher and better things.

Thus it will be seen we have gathered within the fold of this one chair the essential portions of every branch of the entire curriculum.

This has been done naturally without serious effort and without any special loss of time—in fact, with a notable saving of time. In so far as we have obliged the students to study out for themselves those subjects which they are required to know, and to rely upon their own knowledge, rather than that imperfect comprehension, which will certainly result from an effort on the part of the lecturer to include these subjects, exhaustedly in his discussions.

This method not only benefits individuals of one class, but its influence also spreads among the other classes, which are still struggling with the discouragements of the theoretical work of first and second years, and becomes a powerful factor in forwarding the study of these otherwise uninteresting branches.

Thus, in a way, it leavens the work of the entire school.

It seems to me that in each college there should be at least

one chair which would follow this idea. If the criticism was in order, it might be that colleges do not give enough consideration to the comprehension by the student of the course of instruction as a whole, and too often that interdependency of different parts is overlooked.

I would not urge that the chair of oral surgery be always and in every case a nestor for the other branches. It does not follow that this necessarily must be so, yet it certainly seems to offer a most favorable opportunity for illustrating the direct bearing which each one has upon the other in the completion of the structure, which, as a whole, we are undertaking to build up.

It is an indisputable fact that since we must learn through our senses, the effect upon the sensorium with regard to a given idea is certainly more forcible and reliable if in addition to the vibratory register of the auditory apparatus, vision may send a message likewise to lend its weight to deepen the mental effect. Recognition on the part of the individual is much more satisfactory than when either one of these alone is to be depended upon. Therefore, illustration of any kind, whether by chart, picture, blackboard or in other form, is a powerful aid to strengthen the effect of the words of the lecturer.

The plan I follow in my lectures in the dental department of Milwaukee Medical College is intended to employ all of these various aids. The charts here shown are so prepared that each presents a skeleton of the lecture to be given.

The advantage of these is threefold. First, the student in taking notes can, with little difficulty, under each of the various headings given, write what is said regarding that particular portion of the subject, and, as the course proceeds, these notes will constitute a very valuable compend for future reference.

Second. Having the headings and classifications under his eye, the lecturer can easily follow in the order given, and thus avoid the danger of confusion through repetition. Moreover, charts prepared in this way, unlike written lectures, do not limit the scope of verbal illustrations, and before each lecture reference can be made to current literature, or it may be that a review of older writings may freshen the mind of the speaker and suggest new and valuable ideas.

Thus, no limit is placed upon the width or the breadth of his treatment of the subject from year to year, nor is it necessary to follow a single authority as when lessons are assigned.

Third, and last, if not least. During the hour the eyes of the student, fixed from time to time upon the clearly lettered chart, are unconsciously carrying home to each a mental picture that will doubtless remain a more or less clear image, associated with certain facts, to be easily recalled long after those committed by pure memory alone will have been forgotten.

When students become accustomed to a particular form of illustration it ceases to interest them in the same degree that it did in the beginning, or that some other kind of illustrating device would; therefore, variety is beneficial in this regard. I believe firmly that the time is well spent, in beginning a course, by giving up a goodly portion of the first hour to a discussion of what the work about to be considered really means.

In the first place, almost no one knows what is meant from the surgical point of view by the term *oral* surgery, brought into disrepute, as it has been in the eyes of general surgeons, by the attempting of too much by those who claim to practice it, and, on the other hand, belittled in medical eyes, and in view of the laity also, by narrowing the field of treatment to such conditions as almost every successful practitioner is capable of, and does treat every day in his office. Particularly where medical and dental students are associated together, it is imperative that this work should be distinctly outlined at the very outset.

Its scope, possibility and limitations clearly defined, and such encouragement given in the way of illustrations, as may tend to inspire high and lofty opinion of this surgical branch, so that all may understand in this field quite as much is to be accomplished for the benefit of humanity; quite as many new developments remain to be made as in any other branch of surgery, and that the future offers opportunities to the very fullest of ability of the most highly endowed individual.

Thus respect is engendered which must and does do much, as the course proceeds, to hold the attention and warrant the best efforts of the better class of students at least. It is failure to comprehend this simple fact that leads to difficulty in holding the attention and interest of the class, and doubtless for this very reason also it is true that medical men remain ignorant upon many things which they could learn to advantage from this very course simply because this significance has never been made clear to them in the medical school where they received instruction.

Having, then, given one hour to the consideration of pictures of cases we have treated, and of the most interesting ones that have been successfully treated by others, there still remains the advisability of at some future hour again impressing the fact of the far-reaching importance of the secrets that lie within the vestibule of the human body, the entrance to which is our special charge, its circulatory, nervous, lymphatic, muscular and other systems, and the dependence of their proper functions upon the condition of its parts.

The great passageway of the intestinal canal, and each and every organ connecting directly or indirectly therewith—the heart, the organs of sight and hearing, the brain and reason itself—each of these, while they may be dwelt on from time to time, and can be in a limited way during the teaching, must be grasped at one time in order that their full meaning as a whole may be appreciated by the student.

Therefore, I have prepared a lecture in which, by the aid of the stereopticon, all considerations are taken together and treated with regard to their relation to each other.

The influence of such a discussion reaches far beyond the confines of college walls, and must in time make itself felt upon the members of the community at large, and lead in a direction ultimately to bring those individuals who are in charge of institutions for the education of the young, and the care of public health, to a realization of the importance of the mouth as a factor in general disease and its care as a hygienic measure of public necessity.

By the use of the hand microscopes, which are here for your inspection, microscopical sections of tumors, histological, pathological or bacteriological specimens may be inspected to advantage. These, passed about the class, with slides relating to the subject under discussion, bring directly before the mind of each student interesting facts without loss of time, and to good advantage.

The microscopical attachment to the stereopticon enables them to be thrown upon the wall without the necessity of enlargement into regular lantern slides. Their advantage is that we have them shown in the colors that have resulted from the staining, in such manner as will enable them to be more intelligently described than when shown in black and white.

The virtues of the stereopticon cannot be overestimated. They are offset by the single disadvantage, perhaps, that during

the lecture, whenever it is desired that the best effect may be given the class is comparatively in the dark, and there is difficulty on the part of the lecturer in giving and receiving that mutual understanding which undoubtedly accompanies a clear exchange of the message from his eyes to the eyes of his listeners, and back again. Occasionally, too, the question of discipline and order arises, because some member of the class may take this opportunity to disturb.

This, of course, is comparatively minor matter, and can be remedied in other ways.

The use of the blackboard by the lecturer himself is indispensable. Even though he be not an artist, any one can learn to describe, with the aid of a piece of chalk, that which he wishes to be understood. Where it is carried to the extreme of the artistic side, time is frequently expended which might be used to better advantage otherwise.

Moreover, it is not well for the one who addresses the class to turn his back when it can be avoided. Courtesy, at least, demands that he should face his audience, and usually there is some one who is ready to take advantage if his back is turned too often or too long. Rough outlines, however, can be drawn, and more or less ready flow of speech accompany them, so that each stroke can easily be described, and no unnecessary time need be lost.

Having a hospital in the same building with the college, it is possible in Milwaukee to bring cases into the lecture room from the hospital. Of course, clinical cases do not, as a rule, time themselves to particular lectures to be given on particular subjects, but still much can be done with a little care. As, for instance, it happened recently when we had four or more cases of fractured jaws. These cases were brought into the amphitheater, and the subject of fracture was taken up in detail, although out of its regular order in the course. So that the class was familiarized with certain facts which enabled them to understand the cases under treatment, and no repetition occurred, as would have been the case had the cases been described merely with reference to mode of procedure, and then lectured upon later under the title of the regular subject.

This cannot always be done, but when it can its advantages are many to the student. Students should be given the chance to see clinics, as well as to hear the lectures, otherwise they may remain utterly ignorant of the technic of surgical procedure in dealing with practical cases.

Of course, wherever it is possible, students should be allowed to assist in the operations and given opportunity to visit hospital cases, and to witness surgical operations of every nature.

Plaster of paris, the camera and written records should all be combined to preserve for future reference and use whatever may have been interesting or beneficial in the cases that have been treated from time to time by the class.

The what, the how, and the why, according to recent writers, form the basis of all teaching methods. Their significance can only be appreciated by a full understanding engendered through discussion between teacher and pupil. This can only be permitted without loss of discipline in the lecture room by some system of question and answer, therefore one should, whenever practical, allow a few minutes at the end of the hour, during which students may ask questions bearing directly upon the lecture just completed, for it is quite likely that what has been misunderstood by one student may not be clear to the others also, and the nature of the interrogations serve to guide lecturer with reference to the effect upon the class, of the lecture just concluded.

For a like reason it becomes necessary to question the students. In my own work it is my custom to do this in a variety of ways, and for several distinct purposes.

First. To arrest attention whenever a student's eye wanders, or he speaks to his neighbor, or gives other evidence of inattention, I try to fix his thoughts upon me instantly by some direct question—usually one that exposes to the class he has not been following my remarks. The result is instantaneous and beneficial.

Second. I ask questions at the beginning of the hour for the purpose of review, and for the opportunity to make clear portions of the subject that seem to be confused in the minds of the members of the class.

Third. To make students think and use their reasoning powers I am accustomed to ask questions that cannot be answered from the subject-matter of any lecture that may be given, but require conclusions that must be drawn by inference and thought.

It would be manifestly unfair to mark upon answers given upon such questions as the foregoing classes imply, therefore no record is taken.

Fourth. For examination purposes I give written and oral quiz examinations in which an effort is made to get at each individual's

knowledge of each division of the subject as it is passed, his faithfulness and power of both verbal and written expression. In the formal quiz work, students are not required to stand, but in the oral quiz, upon which he is marked, each individual is required to rise and stand as he gives the answer.

Fifth. Final examination, which, in conjunction with marks given through the course, determine whether the advance to a higher grade shall be made, I prepare several hundred questions which cover, as far as possible, every aspect of the entire subject, and with the whole class present, give an oral examination that makes cribbing impossible, and has the great advantage of being the best drill that the class ever gets, because, with every faculty on the alert as answers are given, each student listens to a review of the whole subject from beginning to end, much of which will never be forgotten, and instead of being able to answer correctly a very limited number of questions, nearly every man will be able to pass upon nearly every one of several hundred essential facts.

DISCUSSION.

DR. G. V. BLACK: Rather than let this go by default I will say a word. I am particularly pleased with the outline of the course in oral surgery. A number of years ago I went to Philadelphia, and was especially anxious to see Dr. Garretson operate. I was not particular about what the operation might be, but I wanted to see him operate. I found him exsecting a knee-joint. On the same day I found another man, not an oral surgeon, removing a portion of the lower jaw. My own notion is that we should confine the teaching of oral surgery in our schools very closely to those operations which the knowledge and experience gained in the practice of dentistry will facilitate; or, in other words, those operations which the dentist will be best prepared to perform. Now this depends, not upon his knowledge of pathology as the main factor; not upon his knowledge of disease in general; not upon his knowledge of physiology; not upon his knowledge of histology—we all should have those things—but upon the deftness of his fingers in doing particular things. Take the divisions in medical practice, or the divisions in surgical practice, or the divisions into specialties in the healing art; upon what are they based? Not upon the knowledge of anatomy, histology, physiology, etc., these are the basic principle for us all. They are based almost exclusively upon manipulative procedures. The one

may choose the eye; he trains his fingers, he trains his thought particularly upon the eye, its tissues, the methods of cutting, the methods of handling, the methods of examination, if you please, of that particular organ, and the lesions of that organ; of the ear, we may say the same thing; of skin diseases we may say the same thing; of diseases of the lungs, the auscultation, the manipulations of diagnoses, the training of the ear to the sounds of the lungs in breathing, all these come in for this particular class of manipulative procedures. So we might go on through all the specialties of medicine. They are not based upon a man's knowledge of pathology, physiology, etc., but upon certain manipulative procedures, either in the operative branch or in the diagnostic. There are manipulative reasons, then, for these divisions in medicine or in surgery, and the divisions that are coming up in dentistry. They are manipulative in character.

Now for the dental student, I should say, we should teach them particularly those operations which their habit and practice, acquired in dentistry, render them best able to perform—those operations in the mouth and immediately about the mouth—the tissues that they have learned particularly to handle. A number of years ago I should have included a wider scope in surgery; I should have included operations on the lips particularly and other operations about the face—I should hardly be inclined to do so to-day. Possibly our operations render us better able to handle the lips—to remove cancer of the lips, for instance, but not so particularly so. I have cut a good many of these from time to time myself, but I do not see but the general surgeon can do that about as well as the dentist, but when it comes to a removal of portions of the facial nerves, especially of the third branch, I doubt whether the general surgeon can do it so well. There are certain manipulative procedures that the dentist is accustomed to in this region that will enable him, in many operations, especially those that are appropriate within the mouth, to do with greater facility than the general surgeon could be expected to do; for that reason it falls naturally in the province of the oral surgeon; so do very many affections of the mouth, operations of the antrum, cleft palate, etc. Now these are the classes of cases, then, that I should include in a series of lectures upon oral surgery. Of course the general principles of surgery are important; they must be taught to any class that undertakes surgery of any kind, but they are not especially for dental students any more than for

medical students—that is general, and applies to surgery everywhere. The knowledge of disease, the knowledge of tumors, the knowledge of conditions, that have been given here, belong to the general surgeon just as much as to the oral surgeon. The differences are not based upon these, but based upon finger skill and that which comes from being accustomed to operating in this peculiar region. I remember that when a boy in this work, and in years as well, a surgeon said to me—it was one of the first cases in which I was called to operate upon a very serious fracture of the lower jaw. Says he: "These cases of fractures of the jaws are the most troublesome surgery I have anything to do with." I saw very plainly that he had not had that experience in handling these fractures of the jaws that he had had in the handling of other fractures. He had not had the practice in handling the mouth that I had had, although I was comparatively inexperienced at that time; and that was one reason why he had more trouble with this than other classes of fractures. Another reason was that he was unable to construct the proper appliances.

We can attend to these fractures easier than the surgeon, because it is our field of work and our fingers have been trained to the handling of these particular tissues. I don't know how many dentists ought to undertake the treatment of fractures of the jaws, but those who practice in country districts, or in the smaller towns, will be called upon more frequently than those who practice in the larger cities, and it seems to me that every one of them should be able to take hold of these cases, to handle them for the surgeon, or to handle them in connection with the surgeon. They should be able to take hold of them and handle them on their own responsibility if necessary. I had to do it, whether I wanted to or not, where I got no pay for it, because it happens that those people who get their jaws broken are often not the people that have money, and yet they must have attention from somebody. Sometimes they do have money.

Let me tell you a little story. I was called to go some seventy-five or eighty miles away to treat a fracture of the jaw. I threw together what things I could and took the train. When I arrived at the town I met parties with a wagon, who said it was six miles in the country. When I arrived at the farmhouse at eight o'clock at night I found a very large fat Dutchman with the lower jaw broken in four pieces, with the upper teeth knocked out, by a blow he had

received, all but one or two, and they were too loose to be of any use. The wound was two days old; there was immense swelling of the parts, the soft tissues were cut through in a number of places. The injury had been done by a wheel used in raising hay into the barn, that had broken loose and struck him in the face. It was night time, and the light was tallow dips. Well, some of you who have seen this class of cases can imagine the possibilities that were presented. But at four o'clock in the morning the old gentleman went to the looking glass and looked himself over and said he thought it would do, and I went home. Now such a thing may occur to our students at any time, and they need to have that instruction that will give them the courage to take hold of even such a case as that and put it in shape; and to do so, they will often have to use a good deal of invention. I had nothing to make a splint of except some gutta-percha, yet I made a splint, using a piece of telegraph wire to stiffen it, and tied it on to that jaw with silver wire passed around each fragment of bone, wiring the pieces of bone to the splint in that way.

Now this kind of invention must be brought out in the teaching of oral surgery, together with the instruction in lectures and the instruction given in clinics, the invention brought out by the classes of cases that happen to be presented, and the variation that may be pictured from the cases that come before the class; and in all these ways this inventive genius must be aroused in students so that they will be enabled to take hold of these cases and do them, and do them well.

A case came into our school a few days ago, in which there had been a fracture of the jaw upon one side four or five years ago. The patient came in with a fracture upon the other side that had just occurred. Our surgeon spoke to the class at once, and said: If any of you treat a case of fracture as this old fracture was treated, and should be sued for malpractice, do not come to me as an expert witness. If you do, I shall say at once to the court and the jury that you have not done your duty. The occlusion of the teeth was so bad that when the jaws were closed I could pass my fingers between the molars upon the one side. Now we do not want our students to do surgical operations in such a way. They would be fit subjects for punishment for malpractice if they did.

DR. N. S. HOFF: Mr. President, I do not want my reputation

injured. Dr. Black talked longer than I ever did. He talked so well he has fired me to say something. When Dr. Brophy went home to-night he made me promise that I would talk for him on this subject.

I want to tell you how we teach oral surgery in the University of Michigan. Our oral surgery is taught first by the lecture plan. We have for a teacher the assistant surgeon in the medical department, a very excellent and capable man. He takes a great deal of interest in this work, and presents it as well as he can by the lecture plan. He teaches the general principles of surgery, to begin with; and confines himself, as nearly as he can, to oral surgery, and the surgery of the face and the adjoining structures. He brings such cases as he can before the class. All cases of dental interest which appear in the hospital he gets the privilege of exhibiting to the dental class before they are operated upon, and when these operations are made in the hospital the dental students go to see them. He gives anæsthetics before the class, he examines the patients before he gives the anæsthetics; and does all that he can in illustrating his work in that way. But he is not satisfied with that; and he has suggested that we adopt the plan that is carried out in connection with the teaching of general surgery in the medical department; that is, to have what is called a demonstration course. Sections of the students are taken into the surgical laboratory, where they make all sorts of operations upon the cadaver. Our surgeon has found that the part of the cadaver which is most neglected by medical students is that part which the dental students most need, and he has secured the privilege of reserving the head and the face—particularly the face, mouth and the adjacent tissues—for the dental students.

The class is divided into sections of from ten to twelve, and they are required to make such operations as the demonstrator shall indicate on the cadaver. We cannot make it a compulsory matter for this year, but almost the entire membership of the senior class has signified a desire to take the course. We are doing it largely this year as an experiment, with the expectation next year of making it a permanent feature of the work, and a requirement in the course. Our surgeon proposes to make all operations upon the cadaver that the dentist would be likely to be called upon to make: operations upon the antrum; operations upon the face, and upon the tissues of the face; operations upon the nerve; operations

upon the contiguous portions of the mouth—of every kind that it is possible to devise, and have the students make them themselves on the cadavers. And this idea is also to make fractures of the jaws, and have the students make splints for them. We propose to secure microscopic and lantern slides of tumors from the surgical clinic for the students to study in connection with this course. I have suggested already to him that the lantern slides of the sections made by Dr. Cryer would be very helpful, and we expect to get those slides, so that we may use them in exhibiting the work with the lantern. We also intend to prepare, if we can get the material, wet anatomical specimens; and if we cannot get the material ourselves, to send abroad where such things are prepared, to make this work of teaching oral surgery such that the students will comprehend it more clearly than they can from the lecture course only. It is impossible, of course, to get in a clinic such work for students to do, but we think possibly the students can learn the principles of making these operations upon the cadaver, if not on the living subject. We are just organizing this method of presenting this subject and if any one has done anything of this kind, or has any suggestion to make about it, I should be very glad to hear from him. We want to make it as practical and useful a demonstration course as possible. I do not know that any of you do your work in that way, or have any such work in connection with your schools.

Dr. G. V. I. Brown: I want to call attention to just one or two things that have been suggested. What Dr. Black said with regard to cases that fell into our hands I have found to be properly ours, and the surgeons are mighty glad to get rid of these cases when they can. For instance, we had the other day four cases of fracture at one time, and three of these were almost beyond the possibility of doing anything with, because they had gone on so hopelessly from month to month that a union was impossible for weeks, and one a case where the superior maxillary had been fractured into a number of pieces. (The patient had been thrown down by a runaway horse.) The surgeon brought the patient to me after several months had elapsed for diagnosis and treatment. The patient could not get his mouth shut—you could put your finger in between his front teeth—the entire arch was destroyed—and only by orthodontia methods could the fracture be reduced.

Dr. Black's work is certainly of great benefit. I have no doubt that it will be a howling success.

Before I close I would like to speak of one more thing: that is, the association of these cases. I was able the other day to have four cases of cleft palate to show to the class at one time, each one requiring a different kind of an operation, and each one in a class by itself. One was a child, newly born, a few weeks old, that required an immediate operation, such as Dr. Brophy would perform, in order to keep it alive; the other one was a child a number of months old—too old for that operation, still within the possibility of having an operation in time to have it speak without the usual unfortunate sound. The other was a grown man, all of these three congenital—and one that was acquired in syphilis. When you can take your patients before your class in that way, show them the actual cases and let them understand the relation of those cases to each other, it seems to me they get the idea pretty closely.

NEW FEATURES IN THE TEACHING OF DENTAL ANATOMY AND DENTAL TECHNICS.

BY A. E. WEBSTER, M. D., D. D. S., L. D. S., TORONTO, CAN.

When I presented the flexible rubber tooth form before this society two years ago all agreed that to place the teeth in a flexible base was a good idea. At that time, and even now, I am asked if these forms will be put on the market so that students may buy them. It is the desire to-day to show why each student should make his own tooth form. The former plan of carving the teeth in compound, reproducing these in gray vulcanite, and then recarving and polishing them was a good deal of trouble, but the student got a good training in tooth form. The present plan of carving the teeth out of white celluloid shortens the work considerably, besides increasing the range of usefulness of the form when completed.

Begin every new subject with what is familiar to the student; so in dental anatomy, as a first exercise, have students examine each others' mouths and teeth. The important parts of the mouth and their relations should be made out. The markings on plaster casts of the mouth should be compared with those in the mouth. The bones of the jaws are examined in conjunction with plaster casts and the oral cavity. The relation of the teeth to other parts is studied in a general way, thus laying the foundation for a more minute study later. From the skull and plaster casts is studied the general arrangement of the teeth, their occlusion and attachment to the bones, the classes of teeth (incisors, bicuspids and molars) and their surfaces. When we say that the student studies from plaster casts, skulls and oral cavity, we mean that each man has before him a cast, a skull and a mouth, and the parts are discussed together, the teacher drawing attention to the part he wishes examined, while the student describes what he sees or feels.

Centrals, laterals and cuspids are all studied together from large models, charts, drawings and the natural teeth. All are wedge-shaped, single-rooted, wide mesio-distally, narrow, labio-lingually; representing a general class, and should be studied together. The upper central incisor for minute study is divided into root and crown.

Exact relative measurements are made, e. g.—root and crown—mesio-distal at morsal surface and at the neck—labio-lingual at morsal surface and at the neck. Diagonal measurements from mesio-occlusal to disto-gingival and disto-occlusal and mesio-gingival. Width of labial surface at several points, as compared with lingual at the same points. A tooth may be rapidly modeled up from clay before the class, to show the form of the different surfaces. The students with the teeth in their hands decide the relative measurements mentioned. When there are differences in the teeth held by the students, the question is put to vote, which will give a very good idea of the prevailing size or form. Now a demonstration is given on carving in hard plaster of paris, measurements by calipers in plaster carvings, and as soon as each student shows by his carvings of this material that he has grasped the general idea of the form of the tooth, he is given a rod of white celluloid seven-sixteenths of an inch in diameter, on one end of which he carves a central incisor. A demonstration as to how to work celluloid is made before the student begins to carve this material. At this time the student selects a natural central incisor tooth as a type in size and form that must be followed throughout—plaster casts of fellow students' teeth or those from a skull are used in making a selection of a full set of teeth that will harmonize with the central taken as a type.

The differences between the lateral and central are studied from large models, drawings and the natural teeth. The student then carves the lateral from his selected type. The cuspid is studied and carved in the same way. The bicuspids are studied in general and then in particular, and so with the molars. The celluloid for molars should be nine-sixteenths of an inch in diameter. As soon as a student has carved a set of fourteen upper teeth he begins to think of how his particular type of teeth ought to be arranged to give the most natural appearance. Again he appeals to plaster casts, classmates' teeth and the teeth in skulls, while at this time the teacher is pointing out the general forms from plaster models, charts, lantern slides, etc. In the presence of a number of plaster casts, models, lantern slides and students' mouths, a good general idea of normal arrangement and occlusion may be gained.

The fourteen carved teeth are set up in a block of beeswax, small enough to fit comfortably inside of an ordinary dental flask. A minute study of the soft parts of the mouth is made with as much care as the arrangement of the teeth, using the same aids and using

just as much care in the harmony of the parts. The rugæ, palate and eminences of the roots, etc., are carefully carved out in the wax, and must be in perfect harmony with the size and form of the teeth and their arrangement. When completed the block of wax containing the teeth is invested in the flask—separated—wax removed—and in its place is packed a rubber that will vulcanize in about twenty minutes at 250 F. This rubber must be flexible when vulcanized and yet rigid enough to hold the teeth in position while being worked upon. The rubber may be obtained from any rubber factory at about fifty cents a pound. A pink colored rubber may be obtained, if desired. A more flexible rubber may be placed around the necks of the teeth than that which makes up the main body of the form, thus giving rigidity and flexibility just where they are desired. Previous to setting up the teeth in the wax cavities may be cut in them, which will allow the teeth to come close together, and if wax be allowed to enter these cavities it will be replaced by rubber, which will present many of the difficulties of removal found in gum tissue similarly placed. The whole cost of this tooth form is about forty-three cents.

A general study of the tooth tissues is made from sections cut of the different teeth—longitudinal—and at least three cross-sections of each tooth. Altogether, the class identifies the enamel, dentin, cementum and pulp chamber. If the student knows the external anatomy of the teeth and arrives at the conclusion that the pulp chamber is of the same general form, not very much time need be spent on this part of the subject. Careful drawings are made, showing enamel, dentin, cementum and pulp chambers of the sections cut. In drawings presented the histological structure indicated is that obtained from the chair of histology.

If a student can make fairly good drawings of the teeth and of the different sections and tissues and carve fourteen such teeth as I present to you and form the soft tissues of the mouth and arrange the teeth according to the type he has selected, there is not much question as to his knowledge of form in general and dental anatomy in particular. A student will never make a better drawing or carving than he knows, but he may write down a great deal that is mere information and not knowledge at all.

Dental anatomy should complete the technical work of the freshman year, leaving operative technic for the second year. In most dental colleges—and I am sorry to say it is true in the college with

which I have the honor to be connected—operative technic is completed in the first year. The student with us never enters the infirmary before January of the second year, thus it is, he has not an opportunity to put into practice or review his technic knowledge or handicraft for almost a year after it is learned, while in some schools it is a year and a half from the time he completes operative technic until he enters the infirmary. I am sure every man here has noticed the awkwardness of his own fingers after a holiday of a month or so. If this be the case with men who have been in practice for years, think of the condition of the student after eighteen months' absence from a work in which he only had at best but a poor training. Operative technic should properly begin about two months or so previous to the student's entrance to the infirmary and run concurrently with the infirmary practice for at least a month. The student could apply his technic to infirmary work before mind and hand have lost their cunning. If the student should meet a case in the infirmary that he is not very sure how to proceed with, he may perform the operation on the tooth form or on natural teeth previous to the next visit of his patient. In this way both the time of the patient and student are saved, and mistakes which would be irremediable in the mouth may be made and corrected in the technic room.

One of the most serious objections in the mind of some teachers to the study of anatomy in the manner here presented is the time it takes. Several teachers have said to me that this carving would be a good thing if we had a four years' course, but I say it is a good thing now, or at any time, because it is the most natural and therefore the most rapid manner in which any one can learn dental anatomy. In proof of this I wish to present to you the work done by our students this term. I wish you to be the examiners and decide whether the students who have done this work know their dental anatomy or not. I wish to show you samples of work done in our technic room for the past three years. Note the product—this year's work was done in half the time of last year's and one-third of the time of the year before. The ability of the students is about the same, the difference is in the manner of teaching. We have a class of sixty-eight students, divided into two sections, each section works two and one-quarter hours every other day in the week except Saturdays. The work shown you represents about twenty-five days work of two and one-quarter hours each,

or in all sixty hours. There are few teachers who spend less time on dental anatomy than this.

The committee of this society on the syllabus for operative technic recommends tooth carving, but some will say, Why do carving at all? To such we reply, for two reasons: First, for its educational value, and second, for the usefulness of the knowledge obtained. Carving educates the perception, the acquisition, the memory and reproduction or expression of knowledge. It educates the co-ordination of the hand and mind.

In porcelain crown and bridge work it is essential that the dentist should know the form of a tooth in order to build up the body before baking. In contour inlays a perfect knowledge of tooth form is necessary. In gold crown and bridge work a perfect occlusion is only obtained when the natural forms and conditions are known. In filling teeth the exact form and location of the contact points are essential to get the best results from such operations. In crown, bridge and plate work the dentist should know the normal arrangement of the teeth and their harmonious relations in size and form, and besides he should know the form and relations of the soft tissues of the mouth.

It would seem that to carve the teeth from celluloid and the gums, rugæ and palate from wax gives the best mental and manual training for the time spent upon it. Celluloid is cheap and of the proper color and is easily stained. It is tough and hard, and will take a good polish; it can be moulded to whatever form desired and will bear without deterioration a temperature sufficient to vulcanize flexible rubber about the roots of the teeth. Next year we hope to see blocks of celluloid somewhat of the *form* of the teeth on sale by the depots. In clay modeling *form* is all that can be learned by the student of dentistry that will be afterward useful to him. The material and instruments used and size of the teeth made are all different from anything he will ever use or need in dentistry. The same objection may be urged against carving in soap. Ivory and bone are so hard that the student loses all interest in the work before he gets it cut down to the point where he is thinking of tooth form at all.

Before leaving the subject of dental anatomy I wish to call attention to the strict adherence to the principles of psychology in teaching the subject as has been outlined. "Proceed from the known or familiar to the unknown," e. g., pupils examine each others'

mouths, then models and bones. "Proceed from the general to the particular," e. g., study all the teeth, then classes, then individuals, the whole tooth, then its surfaces." "Appeal to as many of the senses as possible," e. g., *sight,* the large models, drawings, pictures, natural teeth and carvings done in the presence of pupils; *hearing,* the teacher directing attention to certain parts. *Feeling.* As Liberty Tadd said to us last year: "We feel form, we don't see it." The student models, carves and draws the forms, he feels, sees and hears described. "Learn to do by doing." "Practical exercises previous to or concurrently with theory," so-called. "Never theory first and practical exercise last," e. g., no lectures on the development of the teeth until the student has at least seen the teeth and identified their relations to the jaws. "Teach facts by the laws of association," e. g., likenesses and differences between the central and lateral. The main difference beween the trained mind and the untrained is one of classification. The untrained mind remembers each fact while the trained remembers only principles, and by working on these the details and facts in connection with them are thought out by the laws of association. In teaching dentistry the grouping of facts around the principles or classes laid down will put the minds of the students in their natural channels, thereby greatly assisting memory, e. g., it is just as easy to remember that all the buccal and labial surfaces of the teeth are convex as to remember that the labial surface of the central is convex, but note how much more knowledge or information there is in knowing the one than the other.

In teaching operative technics the tooth form is almost indispensable. The rubber dam is applied under almost the same circumstances as in the mouth. The size of piece, the size and arrangement of the holes, inverting the edges of the holes under the free margins of the gums, tying of ligatures, application of cervical clamps, rubber dam clamps, clamp forceps, are all well exemplified in the form. After an exercise on the form, the student should be required to apply the rubber dam to his partner's teeth in at least two locations.

Every possible appliance for the separating of teeth, for filling proximate cavities can be studied. The slow means of getting space works admirably. If wedges be placed between the teeth and allowed to remain for some time, space is gained which will be but slowly closed up on removing the wedge. Immediate separation

is beautifully illustrated, the teeth coming back to their original positions immediately or slowly, according to the time and distance they have been kept apart. Careless or improper use of the separator will result in fracture of the teeth or destruction of the soft rubber about the necks of the teeth. When cavities have been cut upon the proximate surfaces previous to setting up the teeth and the teeth allowed to approximate each other closely and these cavities become filled with soft rubber, the conditions and difficulties of getting space and getting the rubber out of the cavities and getting the rubber dam in position are quite similar to those met with in the mouth.

Grasp and rest practice on the form is very similar to such practice in the mouth. The place in the cavity for the use of each instrument makes good practice. The classification of cavities and cavity nomenclature are as easily learned while the student is preparing cavities in the teeth, as the names of the carpenter's tools are learned by his apprentice. The student learns the use of the chisel, the hatchet, the hoe and the burr. The celluloid cuts clean, hard and tough, is resistant and leaves a good clean decisive hard margin. If the student has seen and examined a sufficient number of decayed teeth for him to have arrived at a conclusion as to the usual locations of caries, he will appreciate what is meant by "extension for prevention" and cutting fissures out to their ends. When a student prepares a proximate cavity, fills it and polishes the filling, removes the separator and rubber dam he sees for himself if proper extension has been made, if the contact point is in the proper location and of the proper size, he sees if the interproximate space has been preserved or not, and the gum properly protected. Compare the advantage to the student of preparing a cavity in a tooth while it is in its relation to all the other teeth with doing a similar operation in a tooth separated from its associates. The seating of fillings and the lines of force are better understood when they are studied with the teeth in proper relation. At this point I wish to make a strong plea for the teaching of dental engine technic. When, where and how to use the engine is more essential to the safety of the patient in the dental infirmary than all the long-winded lectures that have ever been given on the pros and cons of gold and amalgam. Why is it that the student must learn all about the grasps and rests of the chisel before he may work on a patient's teeth, yet he is supposed to know by instinct how to grasp the engine handpiece, no matter

if it hold a stone, a burr, a disk or even a saw? Every student should have a dental engine before he enters the infirmary, and if his operative technic is running concurrently with infirmary work, for a month or so, there is no good reason why the cavities in the tooth form should not be prepared with the burr where its use is indicated. As a rule, every student taken into the infirmary for the first time will expose more pulps with his new engine and sharp burrs in the first few days than he will in the whole of the remaining time he is in the infirmary. The reason for this is that the student, first, does not know when the burr ought to be used, and, second, he cannot control the handpiece. Fillings should be finished in the technic room with the same instruments as in the mouth. Any undue roughness or improper use of files, burrs, stones, disks or strips will show itself on the soft rubber about the necks of the teeth or on the teeth themselves. In no better way can the student study the use and limitations of the different forms of matrices than on the tooth form.

Every kind of filling material may be packed into the cavities prepared in the teeth with the same instruments as in the mouth.

Usually in crown and bridge work technic, the student makes a crown of any size, shape or shade of porcelain, and grinds the root of a natural tooth to fit the band. How much better would the student know the procedures in making a crown for the mouth if he had cut, say, the central incisor, off the tooth form, drilled out the root canal, trimmed the root, fitted band post and cap, selected facing, proper shade, shape and size, ground it up, took impression, invested and soldered the crown, finished and set it. There is no comparison between the two methods for teaching crown technics. The same may be said of bridge work technics. I wish to lay stress upon the opportunities given for the study of a proper selection of teeth in crowns and bridges.

At this time I shall not take up orthodontia technic, but merely show how admirably adapted it is to this class of technic work.

In the study of root canal fillings and the different materials used for the purpose I wish to call attention to the advantages of having each student fill glass tubes the size and shape of the roots of teeth as a first exercise. The perfectness of these fillings may be seen and tested by immersing the fine ends of the tubes into some coloring fluid. After the student has learned by experiment the best way to fill a canal he is expected to fill the root canals of several teeth and later files the teeth down so as to expose the root filling.

In closing, attention is directed to these new features, viz.:

1. The strict adherence to the psychological principles of teaching, as subject is here presented.

2. The harmony of the teeth to each other, to arrangement and to the soft tissues.

3. Carving of the teeth from white celluloid.

4. Implanting these in pink flexible rubber.

5. Usefulness of the form in teaching crown and bridge technics.

6. Usefulness of the form in teaching porcelain inlay technic.

7. Usefulness of the form in teaching operative technics and orthodontia.

8. The teaching of dental engine technics.

9. The teaching of operative technics immediately before and concurrently with infirmary practice.

10. The teaching of comparative merits of root canal filling, materials experimentally in glass tubes whose small ends are afterward immersed in a coloring fluid.

DISCUSSION.

DR. G. V. BLACK: I must say that I am very much gratified to have listened to this presentation, and I do not think I want to discuss it especially.

Some thoughts have come overy my mind this evening while listening to this and looking over these forms, that may seem to some of you to be strange. Here is a piece of carving, for instance, done by a freshman student, and some of you may think it strange if I say to you that there is not a picture in existence made before technic work was begun that compares with it in correctness of the occlusal surfaces of the teeth. Now some of you may not have noted that; but if you will go back over the pages of the *Cosmos* or any other of our journals, or over the pages of the text-books published prior to that time, and study the pictures of the occlusal surfaces of teeth you will find that what I say is true. You may compare them with most of these, and you will be compelled to say that these carvings are better representations of the form of the occlusal surfaces of natural teeth than anything you will find in the illustrations. Yet, to-day we have abundance of good and correct representations of the occlusal surfaces of the teeth in the illustrations in our magazines and in our books. Why? We have

begun studying these things, but we have not reached the limit. In each one of these as I take them up I see errors; they are incorrect, not a one of them correct; but they approach correctness very closely; and considering that they are carvings made by freshmen students they are fine, they are splendid. And the doctor has spoken of the fact that three years ago it took his class longer and last year it took less time, and this last year it took only half the time of the year before. The students were not different, but the teacher was. There is where the principal point comes. Others who have had their students carve teeth have found that their first class did not do it as well nor as quickly as the second, and the third classes would do it still better, and so on. The teacher knew better how to instruct the student. We are growing in this work continually, and these new tooth forms, made in this way, is another of the additions, another of these growths that are cropping out. It is gratifying to see these growths.

Now as to the comparative merits of carving in this celluloid—and it is beautiful carving, it is a beautiful material—and carving in ivory there is some question. The celluloid is much easier carved; the student can carve more forms in the same time; he can study more forms in the same time; and in that there is very decided merit. But the material is different from that in which he will use his instruments later. He does not get manipulation that will have the same benefit in the training of his fingers for future work in the mouth on the natural teeth that he would get from carving bone or ivory. Time and experience will tell.

I must say that I am greatly pleased with these forms, the facility with which they may be put together and the uses that are being made of the forms.

Now as to the natural methods of teaching, I would like to say one word, for I think there are a great many errors among teachers as to that. I think Dr. Webster has been correct in what he has stated in regard to that, and I would like to call attention to it in the matter of teaching nomenclature. It would be very well if the student did not find out that the man who was teaching nomenclature was at that business at all—teaching the names of the teeth. "This is the incisor, why is it called the incisor? Because it is to cut with." Well, that, perhaps is not teaching nomenclature, yet it is. Go on with all the rest in the same way. That is, do not teach nomenclature, but teach things, and give those things their

proper names, explaining the reasons for the name when necessary. That is all there is to teaching nomenclature. And do not call the same thing by two names. I dislike that very much; the students become mixed up when you do that. There has been a wonderful improvement in the use of the terms by the dental profession within a very few years. We go back to the books written ten to twenty years ago, and compare them with the books that are being written now, and notice the nomenclature, and we will find that there has been a great improvement. Many of you do not feel that there has been such a great improvement, but if you will go back and read books or journals from page to page, and note the words used, you will soon appreciate that there is a difference, and it is a difference that is of great advantage to our students. Then I will say follow the natural method; go from that which the student knows to that which he does not know. Let every comparison go immediately back to the subject which the student does know; in nomenclature; in form; in things, and all of that.

G. Walter Dittmar, D. D. S., Chicago, Ill.: Some of these new features in teaching dental anatomy and technics are truly *new to me*, i. e., I have never used them. However, in Chicago, where we rather pride ourselves on giving, what we think, good courses in this subject, we have for some time been using many of the means mentioned.

By the way, we use Black's Dental Anatomy as a text-book, and charts, drawings, models, skulls and extracted teeth to assist us.

Carefully study the physical and anatomical divisions of teeth, dissect teeth longitudinally and transversely. Classify and properly arrange them in sets, make drawings and also *carve*, using natural extracted teeth as models. The latter, i. e., *carving*, I believe with Dr. Webster, to be one of the most efficient methods, to impress dental anatomy upon the mind of the student, and at the same time develop manual training.

Besides the more accurate knowledge attained of tooth form, it develops dexterity and precision with the fingers and carefully trains the eye.

At our college we have never used celluloid for carvings. Yet I know of no reason why it is not a good substance to use for this purpose. However, I do not consider the objections the essayist advanced against the use of ivory as based just right. I do not think that on account of its hardness the student loses interest in his

work before he gets it cut down to resemble a tooth. The fact is, that after he has outlined on his ivory block what he wishes, with a pencil or a pointed instrument, with a mechanical saw and a file, he in a few minutes has roughly the form sought, then with scrapers, chisels, spoons, hoes, etc., he soon works it down to the desired form. Its hardness to work is, if anything, an advantage—if finger training is one of the essential points sought, *and it certainly is.* Then also its physical make-up and consistency are very much the same as dentin. The essayist spoke of using a central incisor as a type, then taking an impression and getting a *cast* with teeth harmonizing with the extracted central and use this cast as a model for the carvings to be made.

Now, providing he uses in conjunction with this model, natural extracted teeth also, I can see the advantage of getting carvings whose crowns at least will harmonize, but unless extracted teeth are also used as models the student forms no accurate conception of the roots of the teeth, a knowledge of which is almost as essential as is that of the forms of the crowns.

I come now to what I will concede to Dr. Webster as the principal "*new feature* in teaching dental anatomy and technics," and that is to have the student make the "form so aptly described by the essayist."

I think this a most excellent idea. It certainly is a decided step taken in the right direction, and deserving of much commendation. Allow me to suggest, however, the vulcanizing of extracted teeth and roots into the "form" for the purpose of applying the technique of treating teeth, pulp canals, abscesses and finally filling the roots. Then, if desired, the adjusting of crowns and bridges.

The psychological principles pointed out by the essayist are unquestionably sound and should be closely followed by instructors. It is certainly only rational to proceed from the familiar or known to the unknown, from the general to the particular, and to teach by association and comparison.

If our colleges required a four-year course I would heartily endorse Dr. Webster's statement: "That dental anatomy should complete the technic work for the freshman year, leaving operative technic for the second."

However, as we now have it, it seems to me that it is necessary to commence operative technic about the middle of the first year.

In the school with which I am associated we do not keep the

student out of the operatory until the middle of the second year, BUT about the last month of the first year, the freshman is allowed to do minor operations in the mouth. And he certainly is more competent at that time than at the middle of the second year, unless, as the essayist suggests, operative technic is taught concurrently with the first few months of the student's operatory work.

This latter, I think, should be done any way. Operative technic work should be graded, and in the second grade, commencing a short time before and running concurrently with work in the operatory is when instrumentation, dental engine technics, grasps, rests, adjusting of the rubber dam, clamps, separator, etc., should be taught.

Just a few words more. A technical term used by the essayist that I do not like and for the use of which I can see no good reason. The word "*morsal.*" I should have used *incisal.*

However, on the whole, I wish to personally sincerely thank Dr. Webster for his most excellent paper. I have profited much from it and the discussion it produced. I believe we all have learned something. I confess I have learned much. He truly can be credited with presenting some New Features in Teaching Dental Anatomy and Dental Technics.

DR. L. S. TENNEY, Chicago, Ill.: While I very gladly consented to say something on this paper, I know at this late hour you will thank me for not prolonging the discussion. I certainly wish to praise Dr. Webster for his paper and for his work. Like every good thing that he has ever presented us, it is bright, new, original, and well worthy of its distinguished author. I agree with Dr. Peck, that we sometimes fall into the error of commending every paper that is presented to us, out of courtesy to our essayists, but certainly there is nothing in this one that any of us could take the slightest exception to. I refer with no little satisfaction and pride to the fact that Dr. Webster was a student of mine, and I am very glad indeed to see him showing so many evidences of his early training. I always knew when I saw him sitting on one of those easy upholstered stools in front of the long benches, that there was within him a latent force that would sooner or later develop into the very talents that he has displayed on so many occasions before this body. Now if Dr. Webster is satisfied with the compliments I have paid him—and incidentally paid myself—I will make just one or two remarks on this paper.

That these subjects are brought far better within the comprehension of the student by such methods as these than by purely didactic instruction has long since become an established fact, and will not admit of argument. It has been said by some one that hearing excites curiosity; seeing satisfies it; and when I note the intense interest with which a class of students witnesses a mechanical operation or demonstration of any kind, and the apparent listlessness with which they frequently will greet the most accomplished and interesting lecturer, I am persuaded that the demonstration method should in a large measure supplant all others. In regard to this particular method, and that is the only thing I am going to speak of, because I do not want to go into details at this hour, in regard to the use of celluloid in carving tooth forms, which has been freely discussed yesterday and to-night, it is agreed, I believe, by those who have used it and those who have not, that it is a most useful addition to our teaching methods. But gentlemen, I, for one, am not yet persuaded that this should take the place of our ivory carving. I suppose we are all prone to follow along beaten paths, but I have met with such gratifying results—gratifying to myself and gratifying to my students, with the ivory work, that I am loath to give it up. Some one has said that the carving of celluloid is much easier than that of ivory, and, therefore, a point in its favor. Gentlemen, that is the very ground of my objection. I like ivory because of the difficulty of the work and because of the painstaking labor that is involved. The student carries the carving of the ivory right along with his other work and other demonstrations, and I submit to you that by the time a man has taken a block of ivory and a molar tooth, and has by the most careful, painstaking and diligent effort, carved its fossæ, fissures and ridges, pits and grooves, and the contour of all of its surfaces, he has an impression of that tooth fixed in his mind indelibly and forever.

What we want, in my opinion, is to have a form like this, made easily, quickly and placed within the reach of all our students, upon which to demonstrate our cavity preparation and filling operations, but we should not discard the ivory carving.

Dr. Kenyon: This topic is one which I am very much interested in, as this is my first year in teaching operative technic, and I have learned a great many things I did not know before.

In our college we have arranged to have the students pass from their operative technic work to the operating room. They are re-

quired to finish completely the operative technic work, and we expect they will go immediately at that time into the operating room and begin to work in the clinical practice.

I wish to commend the courage with which Dr. Webster has advocated engine technic. When I was a student in operative technic I commenced to inquire why I could not have a chance to learn to use my engine on teeth outside of the mouth. Now I don't want any one to misunderstand me. I don't want the student to use his engine in his work when he should be training his hands in the use of excavating instruments, and I do not allow it in my work, but if the student has done a sufficient amount of work by the hand method, entirely for hand training, why he could not have a little training in the use of his engine, I cannot see. Every time I broached that subject to any of our professors I was discouraged, but I never yet have received an answer that convinced me that it would not be a good thing. I was told that operative technic was conceived with the idea of training the hand, and that the use of the engine at all would be out of place in the work. I ask the question, Why doesn't the hand need a little training at least in handling the burr? There is no instrument so prone to jump or slip as a burr revolving at a high speed. There is no instrument we use that is liable to do the damage in the mouth that the surgical engine will do if it is lost control of in the operation. I believe, with Dr. Webster, that the student ought to have at least a little training at the end of the course. I cannot see why engine technic should not be taught just as well as hand technic; it is hand technic applied with a different sort of an instrument; I cannot see it in any other way, and I cannot be convinced that a little of it is not the proper thing at the proper time in the course.

Dr. Webster: In closing the discussion I wish to thank Dr. Snow, of the Buffalo Dental College, for the suggestion in carving in celluloid, and I want to close the discussion by showing you something. It is more or less imperfect. It is an idea of Dr. Charles Pearson, of Toronto, for teaching orthodontia, or prosthetic dentistry, if you desire. We hope some time it will be perfected so that it may be used as a model or a chart for teaching. Dr. Pearson used it for demonstration—the first time before, I think, a social entertainment—a children's entertainment—for making various pictures—little monkey faces, as suggested. Since that time, we have developed it a little bit more, and we have as many noses and upper

lips as you please on a circular frame, so that you can have any kind of deformity you desire in the upper; there are as many in the lower. Before we go to any deformity it is well to show the natural form. I want to show you a type; we will take that of a type of a particular form of face. You note the shape of the jaw. Now you may go over the whole field that you require in orthodontia, you may take a line down the front of the brow, running through the alæ of the nose, resting on the lower lip and touching the chin. You can illustrate that very clearly to a class. They will get the type—the normal type, what they aim to have. Now then, put all kinds of variations—any that you choose; for instance, there you make a sneer of it—and make any kind of lower jaw that you please—lower lip—note the difference here; that is No. 2. Well, come on here, note that chin in the division around here—turn it around again. Note the difference there. See the juvenile nose on there. You may turn in another; look at that lower lip, then put the negro's lower lip on that, and so on. I do not wish to detain you any longer, but you see the principle.

This has been under development for some time. There are some little defects in it that we expect before very long to fix, so that we make four movable areas of the face, each moving separately, but you have grasped the idea.

A MEMBER: Is this original with Dr. Pearson, or did he get the idea of Dr. Case? Dr. Case has used that plan for several years —not the revolving, but the plan.

DR. WEBSTER: I see what you mean. The revolving part is what Dr. Pearson claims.

MINUTES.

NASHVILLE, TENN., Thursday, Dec. 27, 1900.

The eighth annual meeting convened at the Maxwell House at 11 o'clock A. M. with the president, Harry P. Carlton, in the chair.

After the meeting was called to order an address of welcome was delivered in behalf of the local dentists by D. R. Stubblefield, of Nashville. It was responded to by Truman W. Brophy, of Chicago.

The roll call of colleges then proceeded, showing twenty-two represented.

Moved and supported that the reading of the minutes be dispensed with and that they be approved as printed.

The annual report of the secretary-treasurer was then read and referred to the executive board.

The report of the executive board was made by chairman, H. W. Morgan. Moved and supported that the same be approved and adopted.

The report of the local committee of arrangements was then made by H. W. Morgan and upon motion was accepted.

The report of the committee on the Paris exhibit was read by H. J. Goslee as follows. Moved that the same be accepted and approved, and that a vote of thanks be extended to the colleges contributing and to the committee, and that the latter be discharged. Carried.

REPORT OF THE COMMITTEE ON EXHIBIT AT PARIS EXPOSITION.

Your committee, appointed by the chair, and created by a resolution adopted at our last meeting, to solicit and collect from the various colleges in the membership of our body an exhibit of models, charts and technic work of students, to be placed upon exhibition as the contribution of the "Institute of Dental Pedagogics" at the International Exposition at Paris, beg leave to submit the following:

Immediately after their appointment application was made to the offices of the commissioner general for the United States for space, which proved difficult to secure, because we were late and already most of the offices were closed, and all available space previously assigned. Through persistent effort and the courtesy of the

director of liberal arts such was finally granted us, however, and, while not the most desirable, was the best that could be done under the circumstances; and, while preferring space in the department of education, where such an exhibit properly belonged, we had to be content with 6 by 10 feet in the Liberal Arts Building.

Circular letters were then issued at once to each college enjoying the privilege of membership in our body, stating that space had been secured and urging them to join in the contributions to the success of our exhibit.

Owing to the short space of time we had to prepare for same, and because some colleges had already arranged to make theirs in connection with the universities of which they were a part, only five responded favorably. These were the Philadelphia Dental College, the Dental Department of the University of California, the Dental Department of Vanderbilt University, the Dental Department of the Western Reserve University and the Chicago College of Dental Surgery, each of which sent to your committee an exhibit well worthy of representing the work done by the students, and the facilities for teaching of the dental colleges of America.

About this time the work of your committee was somewhat handicapped by the resignation of Dr. Whitslar, of Cleveland, on account of illness and of Dr. Brophy, of Chicago, but their places were filled soon after by the appointment of Drs. A. O. Hunt and D. M. Cattell.

The five exhibits were then properly grouped and arranged, and after being submitted to, and meeting with, the approval of the committee, were boxed and duly consigned to Paris, on or about March 20; and inasmuch as they were of such a nature as to reflect much credit upon our organization, it is a matter of deep regret that we did not begin earlier, that we may have had a larger exhibit and a better space assigned us.

The services of Dr. Winthrop Girling, of Chicago, whose duties called him to Europe about the opening of the exposition, were secured, to supervise the arrangement of the exhibit; and, while he reached there much later than he had expected, and found the exhibit already installed, through the courtesy of the Department of Liberal Arts and of the representatives of Gideon Sibley, he did much to rearrange and add to the prominence of same.

As a whole, however, notwithstanding the energy expended and the faithful efforts of all interested and concerned, your committee,

with apologies and regret, feel constrained to announce that the exhibit was not the success that it, or the society, deserved; but also feel that this can only be attributed to the fact that we planned well but *late*, and that we had no direct representative to receive and arrange things for us at the proper time and in the proper manner.

Arrangements have been made with Gideon Sibley's representatives to take charge of the repacking and shipping of the exhibit at as early a date as it could be removed from the building and the receipt of the same has been daily expected for some time.

In conclusion, your secretary suggests that the thanks of the society should be extended to the colleges contributing, which contribution deprived some of them from making an exhibit at this meeting; to the representatives of Gideon Sibley, and to Dr. Winthrop Girling. Respectfully submitted, (*Signed*)

HART J. GOSLEE, Secretary.

A recess of ten minutes was then declared in order to allow for the presentation of delegate certificates and the payment of dues.

The applications for membership of the Washington Dental College, the Dental Department of the Medico-Chirurgical College of Philadelphia and the Illinois School of Dentistry were read by the secretary and referred to the executive board.

The resignation from membership of the Columbian Dental College of Washington, D. C., was announced and referred to the executive board.

The vice president was then called to the chair and the president delivered his annual address. The discussion was opened by H. B. Tileston, continued by Tenney, Webster, Barrett (read by secretary), Hunt, Weeks, Kennerly, Brown, Brophy, Black and closed by the essayist.

Adjourned.

2:30 P. M.

The meeting was called to order by the president.

The minutes of the previous session were approved as corrected.

The executive board made a report recommending the admission to membership of the three colleges whose applications had been presented and the acceptance of the one resignation tendered.

Upon motion the rules were suspended and the applications voted on collectively.

The ballot being clear it was moved and supported that these colleges be declared elected.

Moved that the resignation tendered be then accepted. Carried.

J. Q. Byram then read a paper on "The Use of Flexible Rubber in Orthodontia and Other Technic Teaching." The discussion was opened by W. E. Grant, continued by Cattell, Jameson, Webster, Weiss, Patterson, Weeks, Brown, Hunt, Goslee, Brophy and closed by the essayist.

A. H. Peck read a paper on "Teaching of Materia Medica and Therapeutics, How and How Much." The discussion was opened by the reading of discussions from James Truman and J. I. Hart by the secretary, continued by Foster, Hunt, Patterson, Black, and was then, upon motion, deferred until the following morning as a special order.

An invitation was then extended by Dr. J. P. Gray to visit the Dental Department of the University of Tennessee immediately after adjournment, which was accepted.

Adjourned.

8:15 P. M.

The meeting was called to order by the president.

Reading of the minutes of previous session deferred.

F. B. Noyes then read a paper on "The Use of the Lantern in Teaching Dental Histology in Its Relation to Operative Dentistry." The discussion was opened by H. T. Smith, continued by Weeks, Cook, Walker, Merrill, Hoff, Morgan, Patterson, Black, Whitslar and closed by the essayist.

Adjourned.

FRIDAY MORNING, Dec. 28, 1900.
10:30 A. M.

The meeting was called to order by the vice president.

The discussion of the paper by A. H. Peck was then continued by Hoff, Brophy, Hunt, Black, Brown, Noyes, Kennerly and closed by the essayist.

The executive committee then reported minor changes in the programme and entertainment.

The secretary made a report regarding transportation certificates.

Dr. George E. Hunt extended a general invitation to all to attend the Tri-State Dental meeting to be held at Indianapolis, Indiana, in June.

Dr. Thomas E. Weeks read a paper on "The Technic of Crown and Bridge Work, Metal and Porcelain." The discussion was opened by N. S. Hoff, continued by Hillyer, Wilson, Goslee and closed by the essayist.

Adjourned.

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2 P. M.

The delegates assembled to leave in a body to visit the Dental Department of Vanderbilt University, from which they left at 3 o'clock on a special car to attend a genuine southern barbecue at Glendale Park.

8:30 P. M.

The meeting was called to order by the president.

The minutes of the previous sessions were read and approved.

The secretary announced that the Southeastern Passenger Association would honor all certificates for one-third return fare in their territory.

Dr. G. V. I. Brown read a paper on "Class-room Method of Teaching Oral Surgery." The discussion was opened by G. V. Black, continued by Hoff and closed by the essayist.

Dr. A. E. Webster presented a paper on "A New Feature in Teaching Dental Anatomy and Operative Technics." The discussion was opened by G. V. Black, continued by Dittmar, Whitslar, Tenney, Kenyon, Byram and closed by the essayist.

The secretary announced an attendance of sixty-five, representing twenty-three colleges, twenty-two of which had qualified.

An invitation to visit the Dental Department of Meharry Medical College was accepted and made a special order for 9 o'clock the next morning.

Adjourned.

SATURDAY, Dec. 29, 1900.
10 A. M.

The meeting was called to order by the president.

The report of the committee on constitution and by-laws, as presented by Chairman G. E. Hunt, was taken up as the first order of business.

The proposed constitution and by-laws were read and adopted, section by section and article by article.

Upon motion they were then adopted as a whole as read and corrected.

Moved that the reading of minutes of previous session be deferred. Carried.

The report of the master of exhibits, George H. Wilson, was made, and was upon motion accepted and approved with a vote of thanks.

The executive board reported a favorable examination of the accounts of the secretary-treasurer, which was upon motion accepted and approved.

A consideration of the next place of meeting was indulged in and discussed by Tenney, Morgan, Hunt, Hillyer, Whitslar and Hoff, but no action was taken and the question was referred to the executive board.

A change in the time of holding meetings was then suggested. It was discussed by Hunt, Morgan, Weeks, Black, Goslee, Gray, Byram, Webster, Patterson, Cattell, Kennerly and Noyes, and referred to executive board without action.

The final reports of the executive board and the committee of arrangements were made by the chairman of each, H. W. Morgan, and were upon motion received and accepted with a vote of thanks.

The election of officers then proceeded and resulted as follows: President, George E. Hunt; vice president, Hart J. Goslee; secretary-treasurer, H. P. Tileston; member executive board (three years), to succeed H. W. Morgan, term expired, W. H. Whitslar.

The newly-elected officers were then installed and responded in a fitting and appropriate manner.

Upon motion a vote of thanks was then extended to the profession of Nashville and their wives and to the Maxwell House, for courtesies extended.

The minutes of this and the preceding sessions were then read and approved. Respectfully submitted, (*Signed*)

HART J. GOSLEE, Secretary-Treasurer.

APPENDIX.

List of Membership Colleges with duly accredited representatives present, dues paid and entitled to vote:

College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Northwestern University Dental School.
Royal College of Dental Surgeons.
Dental Department of Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
Dental Department, University of California.
Indiana Dental College.
Dental Department, University of Buffalo.
Pittsburg Dental College.
New York College of Dentistry.
Dental Department, University of Iowa.
Birmingham Dental College.
Kansas City Dental College.
Dental Department, University of Tennessee.
Southern Dental College.
Atlanta Dental College.
Dental Department, Milwaukee Medical College.
Missouri Dental College.
Illinois School of Dentistry.

BY PROXY.

Dental Department, University of Omaha.

MEMBERSHIP COLLEGES WITHOUT ACCREDITED DELEGATES.

Dental Department, University of Pennsylvania.
Baltimore College of Dental Surgery.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery.
Dental Department, Ohio Medical University.
Cincinnati College of Dental Surgery.
Dental Department, Detroit College of Medicine.
Dental Department, Marion Sims College of Medicine.

Total membership, 32.
Colleges represented by delegates, 24.
Colleges without delegates, 8.
Colleges admitted at this meeting, 3.
Resignations received and accepted, 1.
Dropped for nonpayment of dues, 1.

Respectfully submitted,

(Signed) HART J. GOSLEE,
Secretary-Treasurer.

REVISED CONSTITUTION AND BY-LAWS.

ARTICLE I.

NAME AND OBJECT.

SECTION 1. This association shall be known as the "Institute of Dental Pedagogics."

Sec. 2. Its object shall be the improvement of the educational department of the colleges comprising its membership, by interchange of thought and formulation of methods.

ARTICLE II.

OFFICERS AND STANDING COMMITTEE.

SECTION 1. The officers shall be a President, Vice President and Secretary-Treasurer, the same to be selected from the active members and elected by a majority ballot at the annual meeting.

Sec. 2. There shall be one standing committee of three members, which shall be known as the Executive Board, the same to be elected by a majority ballot at the annual meeting.

Sec. 3. The Executive Board shall be elected and serve as follows: At each annual meeting there shall be one member elected to serve for three years.

ARTICLE III.

MEETINGS AND QUORUM.

SECTION 1. The regular meeting shall be held annually at such time and place as may be decided upon by the Executive Board.

Sec. 2. On the written application of the representatives of seven colleges the President may, on thirty days' notice, call special meetings to be held at such places as may be most convenient.

Sec. 3. Representatives from ten colleges shall constitute a quorum.

ARTICLE IV.

MEMBERS AND DUES.

SECTION 1. Any college that is a member in good standing of the National Association of Dental Faculties is eligible to apply for membership in this body.

Sec. 2. Active members shall consist of accredited representatives from the teaching staff of the colleges holding membership.

Sec. 3. Each college holding membership in this body may accredit one or more of its teaching staff as its representatives and such representatives shall be entitled to all the privileges of the Institute, *except that no college shall cast more than one vote on any matter acted on by the Institute.*

Sec. 4. The annual dues shall be ten dollars ($10.00) from each college, payable in advance. *The dues of a college must be paid before its representatives can take part in the proceedings of the Institute.*

ARTICLE V.

APPLICATION FOR MEMBERSHIP.

SECTION 1. Applications for membership shall be made in writing to the Secretary-Treasurer. They shall be referred to the Executive Board to be reported on at the first session of the meeting after the receipt of the applications.

Sec. 2. A favorable report from the Executive Board, followed by a favorable vote of two-thirds of the voting representatives present, is necessary to elect the applicant to membership.

ARTICLE VI.

FUNDS.

SECTION 1. All funds shall be applied to the necessary expenses of the Institute and shall be paid out by the Secretary-Treasurer as ordered or as bills are approved by two members of the Executive Board.

ARTICLE VII.

ALTERATIONS AND AMENDMENTS.

SECTION 1. Any amendment to the Constitution or By-Laws shall be proposed in writing at a regular meeting. It shall lay over until the next annual meeting and every active member be notified of such proposed amendment, when it may be adopted by an affirmative vote of two-thirds of the active members present.

ARTICLE VIII.

SECTION 1. Roberts' Rules of Order shall be the authority governing this body.

BY-LAWS.

ARTICLE I.

DUTIES OF OFFICERS.

SECTION 1. The duties of the President and Vice President shall be such as usually pertain to these offices in similar organizations.

Sec. 2. The duties of the Secretary-Treasurer shall be such as pertain to the office of Secretary and Treasurer in similar organizations.

Sec. 3. The President and Secretary-Treasurer shall render an annual report.

ARTICLE II.

DUTIES OF EXECUTIVE BOARD.

SECTION 1. The Executive Board shall receive and act upon all applications for membership. It shall receive and act upon all bills presented to the Institute. It shall provide a program for each regular meeting, which shall be in the nature of papers, exhibits or reports from members upon the several topics pertaining to Dental Pedagogics.

Sec. 2. It shall attend to all business of the Institute and render an annual report of its transactions, which shall be published.

Sec. 3. It shall select the place for each meeting and provide the necessary arrangements.

ARTICLE III.

LOSS OF MEMBERSHIP.

Section 1. Any college that is in arrears for two years' dues shall be dropped from the roll.

Sec. 2. Any college that fails to send a representative for three regular meetings shall be dropped from the roll.

Sec. 3. Any college that is dropped from membership in the National Association of Dental Faculties shall be dropped from the roll.

Sec. 4. Any college dropped from the roll for causes mentioned in Sections 1 and 2 of this article shall be required to pay all dues owing at the time it was dropped before it can be voted on for re-instatement.

ARTICLE IV.

MASTER OF EXHIBITS.

Section 1. At each annual meeting the Executive Board shall appoint a Master of Exhibits to serve until the close of the next annual meeting. He shall have full charge of the exhibits and shall make a report to the Institute.

NEXT MEETING.

The next meeting will take place at the Seventh Avenue Hotel, Pittsburg, Pa., December thirty-first, nineteen hundred and one, and continue for three days. A large and interesting programme will be presented.

PROCEEDINGS

OF THE

NINTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics.

(Formerly National School of Dental Technics.)

HELD AT PITTSBURG, PA., DECEMBER 31, 1901,
TO JANUARY 2, 1902.

SIXTH VOLUME, PUBLISHED 1902.

PHILADELPHIA:
THE S. S. WHITE DENTAL MFG. CO.

PREFATORY NOTICE.

THE Publication Committee submits this report of the proceedings of the Ninth Annual Meeting without apology for having made an effort to present only the essence and substance of the discussions, believing that the exercise of such discretion will place on record a fair, liberal, and more interesting statement of the work accomplished.

HART J. GOSLEE,
GEO. E. HUNT,
H. B. TILESTON.

CONTENTS.

I I

ADDRESS OF WELCOME.

BY J. A. LIBBEY, D.D.S., PITTSBURG.

MR. PRESIDENT AND GENTLEMEN: I think the president was well informed when he said "a short speech." The committee said, "We only want a short speech,"—and that is what you will get.

I am very much pleased, gentlemen, to be placed in the position to welcome you to Pittsburg. Most of the faces here are familiar to me, as I see them annually at our National Association; many of them are associates of mine, and it is a great pleasure to me to welcome you to our town.

I understand that one of the rules of your association is that you don't want to be interfered with in the way of entertainment,—that you come here to work. But we don't want you to leave our town without seeing a little of it. If you see nothing but what you have seen since you came in this morning, I know you will go away with a bad impression. I suppose none of you are disappointed in the matter of our cloudy atmosphere; we have a reputation for that. But we want you to see a little more.

Pittsburg is a town with a beautiful history. It was settled here shortly after the Revolutionary War, and the pathfinders to this part were the Scotch-Irish, which class predominates to a great extent to-day, and you will see many of their characteristics even now. Among the first industries of our place at that time was agriculture, and the principal products were grain, wheat, rye, and Indian corn. The only outlet we had for our market was to New Orleans by flat-boat or to Philadelphia and the East by pack, and it was very difficult to carry grain that distance. The result was that the rye was turned into high wines and packed overland. That industry still continues here to some extent. And also the

tastes of the Scotch-Irish are still with us. I must say for our
that you will find one thing if you stay over Sunday; that you
have more difficulty in getting refreshments or cigars on that
than in any other city, I suppose, in the country; we have c
doors on Sunday.

Our city has grown until we are placed eleventh in the list b
last census. It is surrounded by innumerable cities and towns
if we had as much area as all of the cities that are about us, in
of being eleventh we would be fourth, as we have a popula
within an area of fifteen miles, of over 600,000 people.

We have many places of interest we would like you to see.
chancellor of the University, who, raised from a mill-man
become now an authority in astronomy and in the manufacturi
lenses for our finest telescopes, has a laboratory which will
very interesting thing for all of you to see. Then our mills
plate works, or the pipe works. I don't know what the comm
has arranged for you, but if any of you want to see any of
things I will appoint myself a committee of one to assist the ot

Gentlemen, I have nothing more to say than to bid you
hearty welcome to Pittsburg.

RESPONSE TO ADDRESS OF WELCOME.

By D. R. STUBBLEFIELD, M.D., D.D.S., Nashville, Tenn.

Mr. President and Gentlemen: Our president was too flatteringly kind in imposing upon me this task. It would have been pleasant if I had had some time in which to collect my thoughts, but I am afraid that under these circumstances it will not be pleasant to me or to those who hear. But it came with my birth to make some appreciation of courtesies offered and kindness given; therefore I reluctantly, I must say, yielded myself to this opportunity to voice such sentiments for this Institute.

We make our acknowledgments to Dr. Libbey: We appreciate, sir, your cordial welcome, and we hold in pleasant anticipation the interesting points to visit and sights to see. This association comes to Pittsburg, as to other places, because it represents an up-to-date, living, working body, filled with high aspirations and vibrating with life and modern ideas. We represent a profession that, if it be not appreciated in Pittsburg, certainly ought to be. The world is beginning to appreciate it, and Pittsburg with its 600,000 inhabitants, possibly, certainly does appreciate it, or ought to. We will no doubt enjoy in this hall full compensation for our arduous journeys, and we expect to reap personal benefit from this meeting together. We thank our hosts, singly and collectively, and we propose to conduct ourselves so that, should we remain until after Sunday, Pittsburg will not be offended by our presence. If our president gives us his promise to restrain himself, then I think the rest of us may easily follow in his wake.

Personally, I am very much pleased to be in Pittsburg. The first time I ever saw the city was about seven o'clock one cloudy

morning (it seems that is the only kind of mornings they hav here) and as I looked out of the car window I saw a sight that had never seen before. Then occurred to me the words of one our humorists in describing Pittsburg, who said that Pittsburg wa "hell with the lid off." I thought that was just about right. D Libbey says he is going to take us down underneath. I don know whether we can trust ourselves to visit it there,—at lea singly, though we might go collectively. I don't know whether want to go down under the lid or not, but, with his assurance go first every time into every place, I will follow the leader.

In anticipation of our pleasant sojourn, then, I voice the thank of the association for the welcome offered and express our acknow edgments for the cordial greetings.

PRESIDENT'S ADDRESS.

By GEO. EDWIN HUNT, M.D., D.D.S., Indianapolis.

Gentlemen: This is the ninth annual meeting of this body. Seven of the previous sessions were held under the name of the National School of Dental Technics; the last one under our present name of the Institute of Dental Pedagogics. The success of the organization has been such that no apology for its existence has ever been needed. It has probably contributed more, in a direct way, to unify and to elevate the quality of the instruction given in our dental colleges than any other agency. The effect upon the profession at large will be readily apparent in the years to come. We may all well be pleased with what has already been accomplished and look forward with confidence and eagerness to the work of the future.

In casting about for a subject upon which to address you, the near advent of the four years' course and the consequent necessary curriculum changes naturally occurred to my mind. My first thought was that a consideration of that question in this body might be construed as a usurpation of the prerogatives of the National Association of Dental Faculties. But upon receiving encouragement from some of those now present I decided that if we can come to any conclusion on this subject and refer it to the National Association of Dental Faculties, it will save time and work in that organization. In my recommendations I have said nothing regarding the amount of time to be devoted to any subject in any year. This has purposely been avoided. If we can unify the curriculum so that all the colleges teach the same subjects during the same year it will probably be all that can be accomplished. Even that will be difficult.

The first year of a four years' course will naturally be d to elementary and fundamental work. With a view to incr the desired correlation of eye and finger, and especially hope to produce ambidexterity in many, freehand drawing, both right and left hands, will be found most valuable. course should be in the hands of a competent drawing t and should preferably consist of both blackboard and desk ing. The endeavor should be to train the left hand to an amount of dexterity with the right, and to train both to repr on the board, or on paper, geometric and other figures a by the eye.

Several years' trial of a course in physics for freshman students has convinced me of its value. As the entrance re ment is now such that practically all of our students hav high school physics, it will be possible to give an advanced in that subject. This is of such importance that no scho afford to neglect it. The use of the lantern projector an apparatus designed and sold for the pursuit of this study i schools and colleges has made it one of the most inter and instructive branches that can be included in the curric

Biology is another subject that should be included in the of the first year. It broadens the mind, gives that general tific knowledge that goes to make up a well-informed p sional man, and leads directly to the intelligent pursuit of studies as physiology and bacteriology.

Comparative dental anatomy is still another subject tha not received its due measure of attention. It should by all be included in the list. The present drawback to the p of the study lies in the fact that there is no perfectly satisfa text-book on the subject, and the student is compelled to g his knowledge piece by piece, a little here and a little ther all of it obscured by a mass of other matter not directly re to the subject. The best work at present extant is that o Thompson.

I would therefore recommend that the studies of the first be osteology, histology, biology, chemistry, dental anatom development, prosthetic dentistry, physics, and drawing, such histological, biological, chemical, and dental labor work as will naturally occur in the elaboration of the di

course. It will be noticed that I have refused dissection a place in the first year's work. The freshman student accomplishes but little in the dissecting-room, because he does not know enough anatomy to make the course of value.

In the second year I would recommend the following studies: Anatomy, physiology, chemistry, operative dentistry, comparative dental anatomy, prosthetic dentistry, materia medica, bacteriology, and dissecting. The laboratory work would be in the elaboration of chemistry, bacteriology, and operative and prosthetic dentistry. I am classifying crown- and bridge-work in prosthetic dentistry, and would do some technic work in this branch in this year.

In the third year I would recommend anatomy, physiology, chemistry, operative dentistry, prosthetic dentistry, orthodontia, therapeutics, bacteriology, general pathology, anesthetics, and dissecting. The laboratory work would include chemistry, operative and prosthetic dentistry, orthodontia, bacteriology, and pathology.

In the fourth year the studies would be operative dentistry, prosthetic dentistry, orthodontia, dental pathology, neurology, general and oral surgery, dental jurisprudence, and conduct of practice.

This is but a brief outline; the details will readily suggest themselves. For instance, in the fourth year, neurology would include enough otology, rhinology, laryngology, and ophthalmology to give the dental student as much or more knowledge of these subjects than is acquired by the general medical student. As I have repeatedly stated on the floor at these meetings, our endeavor should be to make the dental college curriculum such that the degree of Doctor of Dental Surgery will carry with it a breadth of knowledge and a wealth of attainment that will put its possessor on a plane with those who have taken the degree of Doctor of Medicine. A dental college graduate should have taken practically the same course that his medical *confrère* followed, with the exception of obstetrics, general surgery, and theory and practice of medicine.

The question of examination is one of considerable interest and importance. Too many teachers in professional schools are inclined to believe that their duty to the student has been ful-

filled when they have delivered their course of lectures
rostrum. Loose habits in conducting examinations ar
noted by the students, and information regarding those
who are rigid in their tests and those who are the re
handed down from class to class. There are always s
dents in each class whose thirst for knowledge and who
tion to excel will cause them to do their best without
incentive, but there are more who will neglect certain
if they believe that the examinations in those branche
particularly easy. The object of an examination shoul
so much to learn what the student knows as to learn
does not know. The latter is by far of the most im
The question of how many examinations to hold in a
perhaps best be determined by the individual teacher.
schools monthly examinations are held. My persona
ence with that plan leads me to believe that many in
industriously forget all of the previous month's work
as the examination has been held. This plan also ent
siderable labor on the part of the teacher without p
commensurate results. On the other hand, one examin
the year's work is hardly sufficient, as in order to c
ground thoroughly it would require that a considerable
of questions be asked. It is probable that two examina
year, one at mid-term and one at the close of the year,
the best results.

Whether the examination be written or oral is also
extent a matter of preference with the teacher. There
doubtedly some students to whom an oral examination i
ship. In every class a few will be met that become ne
the point of being unable to express themselves in a
questions orally. The tact of the teacher can here be
overcoming the timidity and giving the student confi
himself. Written examinations are seldom a fair test,
quently result in dissatisfaction among those who ta
fairly. I have seen many teachers who asserted that no
could cheat at one of their written examinations, but I ha
seen a written examination at which a shrewd student c
get illegal help. Many students will exert more pers
and labor in preparing notes for an examination than

cessary to properly prepare themselves for taking it without eating. One objection that is urged against oral examinations the length of time required for examining a large class, but if e teacher conscientiously examines every paper in its entirety e time required is fully as great as that necessary for oral amination.

The following plan has given the best results in my work: ve students are admitted to the examination room at one time, d have each of them five questions asked him. A previous quaintance with their work and their knowledge of the subject displayed in their answers to these questions usually permits e granting of a passing grade to the majority of the class thout further hesitancy. In case of any doubt or in case a dent has failed on one or more questions, additional questions e asked until fifteen minutes' time has expired with this di- ion. These five are then dismissed and another section called. ose who are not clearly entitled to a passing grade are re- ested to come again at a later hour, and at that time are asked m ten to fifty questions until I am assured that they are, or are t, entitled to a passing grade. To cover four months' work h ten written questions is frequently an injustice. It might ily chance that a fairly well informed student should fail on ee of the ten and yet be able to answer ninety per cent. out of e hundred questions covering the same period of work.

n holding oral examinations I have a list of over one hundred estions covering the work since the last examination. A nted class roll makes a convenient paper on which to mark the des. As I ask the question, I put its number down opposite name of the student to whom the question is given, and grade n on his answer. In this way my grade for the examination not my *impression* of his deserts, but the average of the credits en for each question while the answer is fresh in my mind. s method also permits me to refer to each student's examina- n if for any reason that is desirable. I urge upon the members his Institute greater care in their examination work.

n closing this rather defective address allow me to express high appreciation of the honor conferred upon me by my ection as presiding officer of this body for the fiscal year so n to be completed. My acquaintance with dental society work

has been quite extended, but I can truthfully state tha
dency of this Institute, coming as it does without polit
or objectionable ward primary methods, is to me
greatest honors that can be conferred. It gives me
testify to the untiring energy and ability of Chair
Cattell and the other members of the Executive Comm
thanks are also due to the other officers of the Instit
ing that our session here will be filled with profit and
of pleasure, I close with the earnest wish of "A happ
perous new year!" to all.

DISCUSSION.

Dr. J. Taft. The paper presented by the president a
address is one of interest to the profession and of ve
terest to all those who are engaged in teaching. With
there should be greater uniformity in college work th
as yet obtained. There is, however, improvement be
this direction by the efforts of the National Associatio
Faculties, as well as by this body, and the efforts put f
of these organizations should be fostered and every ef
secure the largest and most desirable results for the w

It has been rather unfortunate that there was so mu
of methods in different colleges. The effort should
as nearly as possible a uniformity in the methods of p
order that the college-trained men of all professions
as nearly as possible upon the same level. This is imp
there is so much diversity in the methods of instruc
certainly need be no fear of "a usurpation of the pro
either of these bodies by the other." There is certa
valuable work to be done without a risk of anything of

A few years ago an effort was made to introduce in
of the National Association of Dental Faculties the
methods of teaching. But owing to the preoccupation
of the body in dealing with the principles underlying c
hardly anything was accomplished in the line upon
Association of Dental Pedagogics is and has been at
and has been, the opinion of many that there is amp
room for both of these bodies. The aim of each in
for the same purpose. The writer says, "If we can u

culum so that colleges teach the same subjects during the same ar, it will probably be all that can be accomplished." Certainly objection can be made to this statement, and the attainment of the d contemplated would be very desirable. The definite unification the curriculum of the different schools, so far as the years are ncerned, is certainly desirable, and especially so if students are change from one school to another.

The position taken in the paper, that preparatory technic work the part of the student is very desirable, can hardly be quesned. There is certainly no professional calling in which such ining would be more desirable than in that of dental practice.

That the five senses should be trained to be as nearly under conl of the mind as possible, and that such training should be comnced early in life if the best results are to be obtained, there can no doubt.

The question of securing uniformity in the matter of the use of hands would be, in many respects, desirable if its accomplishnt were easily attained, but, as a rule, the attainment of this end uld be exceptional, especially if it were attempted after fifteen rs of age. The capability of the left hand to equal the right ms in some cases to be a natural endowment; this is quite ceptional, however. While all possible results should be obtained both the hands, we think it quite evident that in a great maity of cases both cannot be brought to the same degree of atment.

With the paper I fully agree that technical training should be l in our elementary schools, and this with reference to all the linary callings of life; and nowhere is it more important than h those who contemplate entering the practice of our profession.

To the statement made in the paper that "Comparative dental tomy, especially of the teeth, is a subject that has not received due measure of attention," no one, I think, would take exception. e author very properly refers to an obstacle that in a measure nds in the way, namely, the want of satisfactory text-books on subject, so that, as he states, the student "is compelled to gather knowledge piece by piece, a little here and a little there." In lition to this we may venture the suggestion that the lack here is as great as in the want of material for illustration in the way specimens. There are very few, if any, dental colleges as fully

supplied in this respect as they ought to be. The w
museum of preparations for teaching in various bran
curriculum is a serious deficiency. Indeed, we reg
equipped library, as well as a museum, a necessity for
training of dental students. The work referred to by t
a very good one indeed, so far as it goes, but we think
son himself would not claim that his work is all that is

The author of the paper advises against the freshm
entering the dissecting room. This view we think cor
believe that the freshman student might have the
manikin along with his text-book to very decided adva
perhaps could be used with greater benefit in the lectu
fore the freshman class during their study of anatomy
after this course the advantages of the dissecting roo
much augmented, either in the second or third year,
training in the lecture room.

The suggestion may here be ventured that the subjec
and sanitary science is not as fully emphasized in this
importance demands. Should it not be regarded as fu
all medical science and practice? The world is beginni
more to understand and appreciate this fact. We are i
with the statement that "The Dental College curriculu
such that a degree of Doctor of Dental Surgery will c
a breadth of knowledge and a wealth of attainment th
its possessor on a plane with those who have taken th
Doctor of Medicine."

The paper suggests several considerations in regard
tions, nearly all of which are valuable. After all, the
examination is one of the vexing matters that is not
mined by any fixed method of procedure. All of the
here presented are worthy of consideration. Some are
one case and worthless in others, and it devolves up
dividual examiner as to the precise method he shall pur
individuals who come within his charge.

Every teacher should study the phases of the menta
and attainments of those who are his pupils. The tea
always be thoroughly interested in the subject or sub
tempts to teach, and should ascertain and use the m
methods of pressing home to the attention of his s
subject in hand.

I cannot do less than express my appreciation of this address of our president. If the suggestions are followed out and utilized as they may be, doubtless a great step will have been gained in the work of the teacher.

J. H. KENNERLY. Some weeks ago I received a letter from the president, Dr. Geo. E. Hunt, saying that he had mailed me a copy of his address, and asking that I tear it all to pieces, as he was looking for trouble. I am sorry to say that I am unable to accommodate him at this time, from the fact that I most heartily agree with most of the suggestions advanced in the doctor's address, while we are all aware of the exceeding versatility of our president as a writer. The subject chosen by him for his address before this association I believe to be especially appropriate for this occasion. As to the consideration of the four-year curriculum by this body, at this time, being a usurpation of the prerogatives of the National Association of Dental Faculties, I feel assured that the chairman of the Committee on Curriculum of the National Association of Dental Faculties, who is present at this meeting, as well as the association proper, will welcome any discussion as well as suggestions that may come from this body to aid them in formulating a curriculum for the coming four-year course of instruction. Even though it be a fact that the four-year course does not go into general effect until the term of 1902-3, yet the discussion of the subject at this time is perfectly proper.

As to the division of the subjects to be taught during the several years of the course, I cannot agree with all the essayist recommends. I do believe, however, that the addition of physics and freehand drawing would be of great benefit to the student. Biology would broaden the foundation,—a thing much to be desired. The placing of dissection in the second instead of the first year would certainly be a great benefit to the student. He would then have had one course of lectures on anatomy, and would be the better enabled to comprehend the complex construction of the human form. It does seem to me, however, that the essayist demands too much of anatomy, chemistry, and physiology. I believe that the average student can get quite a sufficiency of the subjects in two terms of from seven to nine months,—more than is usually taught in medical schools that have a graded course.

The course as outlined for the fourth year seems to me to be

most admirably arranged. The addition of neurology to t
will certainly be of great benefit to the student. It will e
to make a better diagnosis of those cases which involve th
ear as well as the teeth. I had the pleasure some few y
of listening to a paper by one of the leading ophthalmo
the West, which was read before one of the dental socie
Louis, and I am sure that you gentlemen would have este
favor to have listened to such a paper. Concerning the
tion of students, I am in perfect accord with the ide
essayist. I believe that an oral examination is the only one
we can arrive at the desired results. In those schools
classes are very large it would entail a great amount of
not much more than would be consumed in correcting
number of badly written examination papers, and the resu
be much more satisfactory. In conclusion I wish to say
address is a most admirable one, characteristic of the
who prepared it.

Dr. D. R. Stubblefield. I want to commend most c
dress and give to it my hearty indorsement, especially
innovations which we must introduce into our work to a
cover the extended time. As far as these new subjects
cerned, there is no discussion, it seems to me. But I wish
some personal views, that are rather antagonistic, upon th
of examinations. The essayist opens up with a statemen
all indorse, that it is wise for us to unify the curriculu
various schools. Why? Because it gives a uniformity o
tion, and possibly for the benefit of those who wish to cha
school to school, and for various other reasons that I
mention. But why cannot the same idea be applied to the
tions? Further on it is stated and indorsed that only
examination is the proper one. Now I believe that you ca
such thing as an exact examination, impartial from start
without giving a series of written questions. I know it
that a man can write one hundred questions, all of which
tinent to the subject, but I don't believe that any man shou
a student to answer all of them, and I don't believe that
questions he may ask will adequately discover the genera
edge of the student. I think it is beyond question that, if
anything like competitive work, you could not at all appro

definite conclusion by oral examinations. In the first place, if a man asks a question, it is so easy by the very framing of it, by the intonation of voice, to convey to the student, either consciously or unconsciously, the way that it should be answered. You can ask a question with a kind of intonation that is appreciated at once, and the answer would be Yes, or, on the other hand, with a different intonation the answer would be No. So I maintain that no man can do A, B and C justice if there is anything like competitive results to be attained by oral examinations. On the other hand, it is claimed that not every man is able to express himself orally. Well, my conviction is that while a man may falteringly express himself, yet if he has a definite, clear comprehension of the question, sooner or later he will get to the end of it. You can't shake a man's conviction if he has a conviction, but if everything is vague you may throw him off at once. Then we come down to the general principle: How many men will we embarrass by the written questions as contrasted with the men embarrassed by oral answers? I claim that the percentage will not vary very much. Then, what will the ulterior results be? I claim that in the oral examination you can unconsciously aid a man, one with whom you are well acquainted. You ask him a question in a pleasant and agreeable manner that places him at his ease; the other man comes in who scarcely knows you, and he is at a disadvantage. I insist that the only fair way to give an examination is by a limited series of questions which intelligently cover the fundamental principles of the work. We don't expect them to write text-books, but the object aimed at is to find out how well they are grounded in the rudiments of the subject.

Students frequently say after an oral examination: "He asked me five questions and if he had asked me any other of the ninety-five I could have answered them." I claim that you cannot in five questions give a student as fair a chance to exhibit his knowledge from start to finish as you can in ten rudimentary or salient points of inquiry. I say that in the opportunity of quietly writing, all of them having an adequate length of time to give a fair expression of at least a rudimentary acquaintance with the subject, the outcome will be more exact and satisfactory in the end, and come nearer to being a fair test of the average student's ability.

As I say, with reference to the innovation of the introduction of

physics and freehand drawing, the teaching of ambidexte
the study of neurology, we all indorse that, and I congra
president that he has so intelligently looked over the field

Dr. F. D. Weisse. This is the first time in my remem
the transactions of this body that the question of examina
been brought up; it is one fraught with interest and dese
consideration.

When our college was organized and the question ar
methods of examination, we adopted the practice of bot
and oral examinations in order to meet the difficulty,—
men can express themselves in writing and cannot expr
selves orally, and *vice versa*. We have seen no reason
during the years of the existence of the college. There a
ways of varying the oral examination, and I was interest
scheme presented by the president in having five students
to him at a time, as I occasionally do so myself. Th
especially useful where one has a large number of stude
amine in a limited time.

I have adopted during the past few years a method in
examinations that has recommended itself to me increas
more I have used it: I prepare slips with ten question
slip, each slip representing a scope of work to fairly well
department instruction. These slips I roll up and put on
and as a student comes in he draws a paper, the questio
paper constituting his examination. We have all had the e
after examining orally for three or four days, that the
becomes exhausted as to questions without undue repetitio
a student comes out from an oral examination, he is t
pumped as to the questions that were asked him, so th
time the examiner reaches the fortieth or fiftieth stud
somewhat embarrassed for new questions. If you have
papers arranged as above described there is no repetitio
not too much, and the examinations go forward much mo

In our progress examinations at the close of the first a
years we have written examinations only on ten questions
the eight final examinations of the third year are eight
ten questions each—and eight oral. Our experience o
that the student is fairly dealt with, and we have the pos
reaching the student's knowledge of the respective subje

At the New York College of Dentistry we have weekly examinations, the professor of each department examining the class in a body each week. I obtained a very excellent suggestion some years ago from the transactions of this body, namely, that in calling up students for examination in class they be required to stand up. We find from experience that these weekly examinations bring the student into pleasant relation with the professors, and he learns the way questions are worded, so that when he comes up for his examinations he has more confidence in himself.

Dr. W. H. WHITSLAR. I think that in the small schools with which a number of us are connected the matter of examinations is rather an easy matter, for the reason that we come into such close contact with the pupils that we know their characteristics and are acquainted with what they know in the matter, so that we can tell without formal examinations exactly what their grade should be. Therefore the question of a written examination is a mere formality in most cases. We know a man by his work, what he is accomplishing and what the man really deserves in point of percentage in his work. I do not wish to go into the question of examinations farther, because I think the prime object of this paper was to discuss the curriculum of the colleges. The address began very courageously at the bottom of the scale by beginning with the subject of biology. Working from biology into the higher field of histology we come to the use of the microscope, and with this, freehand drawing. The use of the microscope should be thoroughly taught. It is a fine training for the hands and eyes. Then, following the line of histology throughout the normal and pathological studies, working up to that of bacteriology, which should receive its due portion. These are studies which come along progressively and should be utilized in all of their senses. I would like a place in the curriculum for physics, and if I were permitted to name it I should call it dental physics, because that name implies to the student information which would be applied directly to its use in dentistry. Then dental physics leads us properly to the consideration of electricity, and that has a place in the curriculum which I think the essayist did not mention. We should study electricity and its use in dentistry, and study the utilization of this force in its various phases,—in cataphoresis, in the use of instruments and engines, in the therapeutic application of this force in many ways. This should not be left out of the course.

Neurology is a very important study, I believe, and sho
in the fourth year. I have to congratulate the preside
address. I think it is very able, very timely, and I feel t
selected a proper subject for our discussion.

Dr. W. C. BARRETT. What is the object of *dissecting*
to be considered a special study? Is it our aim to teach stu
to dissect, or is that but an adjunct, like the study of a b
study of anatomy? Do we study anatomy to learn how
or do we dissect as a part of our study of anatomy? If t
practical anatomy should be at the close of the cou
senior study. If the latter, it should begin our study.

Bacteriology. I think this should be put in the third
cause it requires the consideration of so much of physic
something of pathology. Bacteriology is an advanced
great importance, but its comprehension requires much p
study. Hence it should be a senior study.

Surgery. We do not teach surgery to dentists as w
Dentists are not surgeons; they do not take the surgic
their operations. If the average dentist has to extract a
tooth, he goes to work with a pair of forceps, and there
one out of ten who will adopt any surgical measures p
the attempt at extraction. Instead of laying the tissues
exposing the tooth and bone to view, according to sur
cedures, he is too apt to begin with a pair of forceps and
gnaw until he has gnawed off all the tooth that is exp
then he quits. We do not teach students to take a sur
and to adopt surgical procedures. We hear a great dea
talk about surgery. There sometimes are state exami
surgery from men who haven't the first conception o
procedures, and who never served time on a hospital cor
lives.

Comparative anatomy. I think that should lie at the
all our elementary instruction, and comparative dental
especially, should be an absolute essential. Some of you
I have taken considerable interest in this work. Wh
competent writer took it up and was invited to prepare a
for schools I laid it down. I have lately begun work aga
I shall produce is more than I can tell. But, gentlemen
not given sufficient attention to many things that shoul
subjects, and one of them is comparative anatomy.

Dr. J. D. Patterson. From whence did you learn that the usual operation of extracting an impacted wisdom tooth was to go at it with the forceps? We don't do it that way.

Dr. Barrett. I learned it by experience, in the first place. In the second place, I learned it by quite an extended observation. In the third place, after I had made some progress in surgery myself, I learned it from some outrageous reference cases that were presented to me in the course of my own practice.

Dr. W. E. Grant. I was unfortunate in missing the president's paper, but have heard enough to know that the turn of the discussion has taken to the consideration of the curriculum. I am very anxious to say something on the subject of anatomy, especially of the dissecting course. My observation has been that there are hardly two schools in this association that work along the same lines in the anatomical laboratory or the dissecting requirements. There are some schools, I am informed, that allow the student to complete his didactic work, and even issue certificates passing him on anatomy, before the student has been in the dissecting room. A great many schools allow the student to complete his anatomical course in one year,—devoting to the practical course time varying from three to six weeks. We certainly need a more uniform system along this line. I believe myself that a student ought to have two courses of lectures of two to three hours a week and serve two years in the dissecting room; these dissecting courses ought to be of at least six to eight weeks in length, six days in a week, and at least two hours each day. And for the life of me I can't see how a student has completed his course in anatomy until he has dissected. I think we are cheating ourselves financially and we are robbing the student of a very important instruction by allowing him to complete his course in dissecting in one year of two or three weeks and collecting one fee for it.

I commend the suggestion that we should add physics to our course. We have been teaching a little physics in our school and find it very beneficial. And I am also very glad to hear the suggestion that biology should be taught in the schools.

Dr. A. O. Hunt. I am very much pleased and interested in the subject chosen by the president—the curriculum of a four-year course. I think we have all thought over this carefully, and I must say that the arrangement presented to us to-day meets with my

approval in nearly all respects, particularly of the work ad
freshman year. I think that if we fail in any part of our c
it is usually in the freshman year. Students come from a
order of education into professional schools; they come fro
room recitation. They are not accustomed to lectures;
not accustomed to getting the best out of lectures, an
happens that a portion of the session is gone before a
really at ease with himself and becomes familiar with th
it is presented. More than that, the advancement along
of teaching in every educational institution in the world
on the increase. The subject that I wish to talk about
ticularly is that of biology. There is probably no branch
that will be so valuable, so important and useful to the
student, if properly conducted. He not only begins to le
appliances, but he begins to learn something of the fun
of the human family by comparison with other organ
one time in my experience it happened that we were not
sufficient material for proper dissecting and we were
severe test of finding a substitute. At that time the dis
dogs was substituted, and I was perfectly astonished to se
results obtained from that experience. Further than th
laboratory course in biology, such as a student passing th
scientific course of a university gets, prepares him for
coming after much better than anything that I am fam
and I desire to thank the president very much for his ar
of studies for a four-year course, and especially for the
tion of biology.

Dr. A. E. Webster. Not being a manager of a denta
do not look at the formation of a curriculum from the sa
point that some other men do. The statement has been
or twice that the curriculum should be formed so that i
uniform and students might move from one school t
That is a very poor basis. There ought to be some basa
on which to arrange this matter. It is best to teach anat
the first or the last year, and it should be put in *that* year
is the proper place to teach anatomy. We should base th
kind of pedagogics first, not on convenience.

Dr. G. V. Black. It is apparent that the teaching o
has not yet crystallized into permanent form. We a

history; we are making an effort to get at correct principles of the presentation of subjects which develop a knowledge of dentistry. It will take years yet to get this properly placed. I should be very glad to see the subjects proposed in this curriculum written out and then presented, or a sufficient number of copies made, and that each man who has thought along this line write a statement following each one of these, as to where he would place it and the time he would give it. The subject of bacteriology may be well placed early in the session, if it is simply biological bacteriology. It may come toward the end of the term of pupilage if it is pathological bacteriology. It depends on *what* is to be taught as to the time at which it should be placed. And so we might state of various other things. We have been spending considerable time in the discussion of this subject and I want only to enter these suggestions. This is a matter that we must meet in the very near future in the arrangement of the four-year course, and as Dr. Webster has well said, it should not be arranged for convenience simply, but on a logical basis of the presentation of these subjects to students.

Dr. J. D. PATTERSON. I appreciate what Dr. Black says, that this matter of a final settlement of the curriculum of dental studies is not yet crystallized, or may not be for many years. It seems to me that we have gone at the matter in the wrong way. Instead of requiring that the young men who come to us to study dentistry must have had a certain amount of preliminary education, we have increased the number of terms and have gone at the matter of crystallizing this dental education in the wrong way. In 1896 some of us were very sanguine that we had commenced dental education in the right way when we outlined a course to pursue, demanding higher equivalent for entrance, and we were happy. Then, I believe when we were at Old Point Comfort the next year, we killed, I might say murdered, those good resolutions and went back to where we were in 1893 and 1894.

I challenge anyone going through the schools and testing the capacity of the students to say that what I state is not true, viz, that entrance requirements are about as in 1893. What is the use of discussing uniformity of methods of curriculum as long as we do not have uniformity in the material to which we are to teach dentistry? My belief is, as has been so clearly set forth by Sir Michael Foster, that the foundation of dental education must com-

mence with a broad base and finally reach up to a cone point of that cone shall be the future dentist. After two years of university study, then commence toward the den the allied sciences, the study of biology, histology, physio on up until we come to the strictly dental studies, which be four years of seven months each. So I say that we l at it in the wrong way, and until we get the basis in the ability of our students, what is the use of talking about ity? It seems to me that is rational, and I want to imp you that we must go back to the better plan of advanced requirements instead of increasing the time of study. Let one of us, if we have not done so already, commence from to insist upon and work for a higher entrance qualifica that entrance qualification shall stand for work in the allie which afterward will point up to, and make, what we beli perfect dentist.

Dr. E. C. Kirk. I had not intended to discuss this m the remarks of Dr. Patterson have stimulated me to say s I am heartily in sympathy with his protest against sadd elementary preliminary studies upon the dental educatio tutions. It seems to me that the preparatory school shou to the dental school suitable material upon which to superstructure of a professional education. I regard it a rage that we have to teach elementary physics; that we to teach elementary chemistry. There is no study wh greater general utility than a knowledge of elementary and it should be made an obligatory study in the pr schools. The professional school should be concerned teaching the application of these fundamental principl needs of the professional man. I am heartily in accord idea of teaching applied physics, but it seems to me tha paratory school is the proper arena in which to teach e physics as the foundation upon which to erect our superst physics as applied to dentistry. I want to say something fully, and I do not wish to be misunderstood about it. deal has been said here to-day about the teaching of ana seems to me that the one thing that has characterized th curriculum from the beginning has been the importance attributed to a knowledge of anatomy. It has been the o

subject a knowledge of which has characterized the professional man in medicine. Naturally this is so, because if we look back through the history of medical science we see the immense benefit which the study of anatomy has conferred. But I ask the question, Have we not somewhat over-magnified its importance? I ask you in all seriousness, Does not the medical man, does not the dental man have more daily, hourly need for a correct knowledge of pathology and therapeutics than he does for a knowledge of anatomy? How many teachers in this room feel that they could go before the professor of anatomy in their own college and pass a creditable examination in that subject to-day? I admit the practical use of anatomy, but I don't want to overestimate its value. It seems to me that a correct knowledge of pathology and therapeutics is of infinitely more value to a professional man than an equivalent knowledge of anatomy. Of course, a knowledge of bacteriology, physiology, chemistry, and subjects of that character are intimately correlated with the knowledge of pathology. Let us have all the anatomy that is needful for our purpose, but let us not give it an undue proportion in our dental curriculum.

I want to say something about the four-year course. There has been large provision made in the suggestions here offered for the study of biology, chemistry, surgery, neurology, and some other desirable things, but may I ask, Where is dentistry coming in in connection with all these new additions to the curriculum? A knowledge of electricity in dentistry would be desirable. I was wondering why you didn't suggest photography and radiography also. Dentistry is specializing rapidly. Take such a subject as orthodontia; it is now almost a distinct dental specialty, we now have a special organization of teachers who are developing that important department. But that does not represent the knowledge of orthodontia needed by the average man. So it seems to me in teaching the subject of orthodontia we should give to all of the students in a dental class an average amount of instruction in orthodontia,—we should have the principles of the subject of the etiology and the therapeutics of malocclusion of the teeth generally inculcated; but you all know in your experience as teachers that during the progress of the course men develop certain tastes, certain inclinations, and it seems to me that it should be a specific function of the fourth year to give to those men an opportunity of

higher instruction in the branches in which they are b
inclination specializing. All dentists are not alike. We ca
men in molds. Every man in this room has his specialty
sort. Dr. Barrett is asking for better instruction in co
dental anatomy. That is all right, but I am not sure t
man would agree with him that a knowledge of comparat
anatomy is one of the essentials of a dental course. I wo
fore suggest that the fourth year of the curriculum shoul
opportunity for the training of men in purely dental electiv
I marvel that something has not been said regarding givi
thorough course in physical diagnosis. I think that is
importance than biology, at least than the kind of biolog
been here alluded to. I would like to say something a
hand drawing. Why should we give dental students
course in freehand drawing? It is a very good thing in
for the ends of dental education should not be confined to
ing of geometrical figures, but rather to the delineation o
dental anatomy. In other words, we should, in our e
system, begin at the beginning, as Sir Michael Foster has
the idea simply and definitely that we are going to make
And I will agree with you to make the base just as bro
sible, but let our educational system tend to *make dent*
last, and all the time.

Dr. N. S. Hoff. From what you have just heard I tru
beginning to realize that you won't have much trouble i
four-year course when you come to it. I have had a l
rience in devising a curriculum for a four-year course, an
nearly downed me before I got through with it. I hadn't
it very long before the question was not as to wheth
enough to put in the four-year course, but where we w
to put what we must incorporate in a course designe
students for the practice of modern dentistry. When yo
putting in the things that are necessary in this course yo
that you have not time enough. You will not be troubled
much biology you are to teach, or how much padding with
sciences or arts which have no direct bearing on the prac
of the course, may be necessary. If you add to your c
only such studies or courses as are necessary from th
aspect, you will find that you have enough of these pra

jects, and more than you can possibly teach in the four-year course. That is the experience that I have had, and I want to simply drop it in here. Don't be afraid that you are not going to have plenty of things to put in, for I can assure you that you will have to cut out many things that seem very desirable.

Dr. Geo. E. Hunt. It will take a very few minutes for me to close this discussion. If Dr. Stubblefield by his intonation suggests to the student the reply that he desires, he is not a good examiner orally. I have over twelve hundred questions which cover my course in operative dentistry through the three years. I have had those questions printed and the students can get them. There are about four hundred questions for each year's work, and if any student is able to answer all of those four hundred questions correctly that is all I want to know about his theoretical knowledge. In examinations you should try to find out what the man knows, and not what he does not know. If I find he is informed on a subject, I drop it and go to something else.

In regard to this curriculum, I had no idea that we would come to a conclusion to-day. In fact, the hair-pulling has been so limited that I have been a bit disappointed. I thought it would excite more discussion than it has, and would be much pleased to see a committee appointed to report at our next meeting regarding the ideal four-year course.

SYMPOSIUM ON THE EXECUTIVE W OF THE FACULTY.

EXECUTIVE WORK OF THE FACULTY.

BY E. C. KIRK, D.D.S., PHILADELPHIA, PA.

I SUPPOSE that the object of this symposium is to brin expression of views as to faculty work and the manageme course of instruction in dental schools. The school with am connected is a department of a university, and is there ject to the general university management. I presume simplest way to give you an idea of our management wo read to you from the statutes of the trustees, which are of the university, that portion which relates to the manag affairs in the dental school. Those regulations are as foll

"The officers of each faculty shall be a dean and a secreta dean shall be elected annually by the Board of Trustees, secretaries by the several faculties."

(I may say with regard to that by-law that all of the o the University of Pennsylvania are elected annually or annually, which is a provision made by the trustees so tha a man may be found unfit for service for any reason wha may simply fail of election. It is a protective system on of the university that provides means for closing out the with any officer or teacher after one year.)

"The provost shall appoint a dean *pro tempore* in the absence or inability of the dean or of a vacancy in the offi dean of each faculty shall in the absence of the provost p the meeting of the faculty, appoint standing committee faculty, and shall call meetings of the faculty when he necessary, or upon request in writing of three member faculty. He shall be the official organ of the university

the faculty and the provost, and through him communications may be presented to the faculty.

"He shall have a general oversight of the instruction given in his department; he shall be charged with the government of students, and shall enforce discipline. He shall be considered an officer of the Board of Trustees, and shall be directly responsible to the board.

"The deans of the several faculties shall have the care and supervision of the buildings and grounds appropriated to instruction under their several faculties, unless otherwise ordered by the Board of Trustees. The dean shall enforce such care and supervision through such officers and servants as the Board of Trustees may provide.

"In any faculty a sub-dean may be appointed by the Board of Trustees to do general work belonging to the dean's office under the direction of the dean, as may be advisable and the board may direct. The dean shall approve all requisitions for supplies for his department before they are submitted to the provost.

"The secretary of each faculty shall keep the minutes of the meetings of the faculty, preserve papers, lay before it and conduct such correspondence as it may direct."

The meetings of the faculty are called largely for the purpose of consultation, and for the purpose of securing an harmonious adjustment of the several elements of the curriculum. As everyone, I think, who has had experience in the management of college affairs will admit, each teacher having charge of a department becomes more or less impressed with the idea that his particular department is the most important one in the curriculum, and we find it necessary, when so many are imbued with the same idea, to get together and consult with reference to an adjustment of the relative proportion of time and energy which shall be given to each department of the curriculum. That is one object of the faculty meetings. Another object is the outlining of a policy with regard to the rules and regulations which shall govern the conduct of instruction, the question of rules for admission to advanced standing, for advancement in the course, rules affecting graduation, and so on. These rules having been established, it then becomes the function of the executive officer of the faculty, the dean, to see that they are properly carried into effect. I may say that the tendency in the University of Pennsylvania, with respect to all of its depart-

ments, is to enlarge from time to time the power of the d
management of the department. That may at first sight
have the objection that it is likely to make the dean an a
that it may develop a tendency on his part to enforce his
ideas; but, on the other hand, there is ample provision
from anything of that sort by the by-law of the Trustees
for the removal of the dean or anyone who is likely t
obstructive in that or any other way. So I think that in t
management of the faculty affairs, where the dean is in
with his faculty, the more the power of the dean can be
with safety, the more smoothly will the department be ma

There are a great many questions that it is impossib
faculty as a whole to act on promptly, and a dean being in
ous accord with the members of his faculty, and havin
relation with the student body than any other single m
the faculty, is perhaps in a better position to take pron
with regard to any new matter which might arise than
be if he had to call a meeting, or if he had to submit the
committee or go through a lot of red tape before action
taken. In other words, I would make the plea that the
the dean be enlarged as much as possible within limits
and that his faculty should stand in a consulting relatio
so that in any case of necessity he may have the benefi
advice, but he should be as unhampered as possible in t
management of the department.

Now with regard to the distribution of work. We re
member of our faculty as practically supreme in his ow
ment; that is to say, what he shall teach is a matter of his
tion, and how he shall teach it is also a matter of his own
But he subdivides the educational work with the instru
are provided for his assistance in his particular depart
we try, as far as possible, to make each head of a departm
the member of the faculty and the chief demonstrator u
responsible for the smooth running of that departme
organization is analogous to a military organization, so th
of irregularity or discipline in any department the dean
deal with the individual student until after he has had the
that the case involves something that the instructor h
himself unable to adjust.

The suggestion which was given to me in regard to this symposium was a very general one, and I have endeavored to put before you the way we manage our affairs as nearly as I could in accordance with that suggestion. I don't know that I have anything further to submit on that point.

The PRESIDENT. Do you have regular meetings of your faculty, and do you experience any difficulty in having the members attend these meetings?

Dr. KIRK. We find a necessity for calling occasional meetings of our instructors for the discussion of just such problems as come before this association, as to methods of teaching. For example, I recently found a difference of opinion existing among certain instructors as to the proper method of taking impressions of the mouth in plaster of Paris. I found that one man was imbued with one set of ideas and certain other men with another set of ideas. There is one thing that we insist upon, and that is that whatever differences we may have among ourselves, they shall not be presented to the class. So that when this particular difference of opinion arose I simply called together the men who would in the course of their work of instruction be required to take impressions or give instruction in taking impressions, and by conference that matter was adjusted at once. So that occasions of that sort may arise where we bring a group of instructors together to study out any difference of opinion that may occur.

We have regular times for faculty meetings and seldom have any trouble in having all the members present.

EXECUTIVE WORK OF THE FACULTY.

BY J. D. PATTERSON, D.D.S., KANSAS CITY, MO.

IN my remarks this morning in discussing the president's address I stated that in order that uniform executive methods shall be followed we must have uniform ability on the part of the students, and I do not wish to repeat what I said upon that point.

I think that Dr. Kirk is perfectly right in allowing the dean to be an autocrat. If the dean is not an autocrat, I would not want to go to his school. If a dean does not know his specific duties, we can't

inform him. If he understands not his specific duties advise that faculty to get another dean. I have found th must be an autocrat, and I have been fortunate in that I allowed to be an autocrat. I go along in a way which about right, and we get along very nicely. I don't belie of these questions that are suggested,—Do you have regu meetings? How do you secure attendance by the profe lectures filling up their time, and How to prevent one le encroaching upon the subject of another lecture, are quit dignity of this body to discuss, for the reason that the en of each individual faculty must decide upon what the r that faculty shall be. We are supposed in our colleg faculty meetings once a month, but I assure you in the l five years there have not been more than three or four fa ings during the whole term, because we didn't need the we slighted anything by not having these meetings, but use of having meetings unless there is something to dis as Dr. Kirk says, when there is anything of importanc all there.

So far as our lectures are concerned: Five years ago the plan of every man getting a certain amount of every lecture, and if he is fifteen minutes late the hour i That is the way to settle that question, and I assure you the last three or four years our record shows very few this regard.

It has always been a question and a quarrel among facu one professor overlapping and encroaching upon th another. Now, my candid opinion is that it does not difference if they do. So long as what is said is correct, if it be repeated? The competent lecturer would scorn to confined within certain limits, and so long as he does his well, let him invade other territory once in a while if doing it.

These questions are very simple and should be left dividual faculty.

EXECUTIVE WORK OF THE FACULTY.

BY D. R. STUBBLEFIELD, M.D., D.D.S., NASHVILLE, TENN.

Mr. President and Gentlemen: First. What are the specific duties of a dental college dean? From the very nature of the case it is almost if not entirely impossible to give a correct answer to this question. Colleges differ as individuals, and the controlling influences that limit the duties of the respective deans in the one case are very different from those that operate in another. Holding the mirror up to nature, if I may be permitted, suggests to me to say that the duties of a dental college dean consist of everything that is to be done about a dental college except what he can prevail on somebody else to do, which is just as little as possible.

Historically considered, a dean was a presiding officer, and his presidency was primarily restricted to *ten* individuals, as its etymology indicates. As colleges do not limit the number of their faculties to ten the name is etymologically obsolete.

The old English idea added to that of presiding officer the duty of conducting the religious exercises of a college faculty. This also is obsolete, in America at least,—unless this deponent is wofully out of date himself. We see, then, that the idea of presiding officer, with sundry other duties varied and extended by the special environment, is about all we have left in the term. The specific nature and extent of these obligations must be varied by the nature of the bonds that bind any faculty together. Faculties, like some other joinings together, are not always harmonious throughout, and incompatibilities, as well as other incongruities, are sometimes in evidence. Such conditions would modify the special duties of the presiding officer. Again, if the college was virtually a stock company partaking of the intrinsic nature of a commercial enterprise, that would necessarily modify the special duties of the dean. The specific duties, therefore, of a dental college dean as presented in this symposium must consist of individual word-pictures by each contributor. If this Institute succeeds in obtaining a succinct tabulation of those special duties from these heterogeneous portraitures it will have great reason to congratulate the committee that suggested the effort.

In the faculty with which I have the honor to serve, the traditions impose upon the dean not only the central idea of being presiding

officer, but he is expected to hold himself responsible for
tenance of the work in general. He is the nominal he
faculty, and sometimes he is the head,—especially if the
thing unpleasant to perform. He is the nexus between tl
ment and the university, and to him all official business i
and all communications are addressed. Within the d
proper he is the great It. He is not the janitor, but he is
to know where the janitor is, to know at all times what
doing, to know where he is when he is not anywhere,
the committee of arraignment for all his shortcomings.

He is financial agent. He must not only collect all
the students have money, but must see that they get it
haven't, and then cover the same into the treasury of the
He is expected to enroll a large class,—the larger the be
to rigidly uphold the entrance standard against sundry ic
predilections exhibited by the average American youth, w
himself perfectly prepared to study any profession wh
gotten his own consent.

He is expected to prevent all collisions in the lecture
fill all emergency absences at a moment's notice, heal al
between his colleagues, and to be able to cordially "hot-
lecturer upon sight. He is expected to hear all com
students and settle their discontent, to make good stude
youths who have never studied anything but mischief, an
oil upon the troubled waters should insurrection come.
pected to imbue every student with a burning desire to o
to swallow with avidity every vagary, however contradict
be, that may be hatched in the amazing incubator of any p
genius; and to be the father confessor,—mental, moral,
and religious,—of every single man. If he is not a dem
he is expected to see that the demonstrators are ev
"cocked, primed, and loaded." He is expected to be
committee of the faculty and to do the work if it is d
Indeed, there are times when he seems to be the grea
Ishmaelite, with the hand of all men against him. He is
to be the most extravagant of men, for he must give more
effort of mind and body for little honor and less money
man living outside of a penitentiary. He is less to be en
a man with a boil on his nose, and more to be pitied than

devil whose only assets are a mortgage and a mother-in-law. The only bow of consolation that spans the dark horizon above his cheerless existence is the living conviction that any hereafter will be heaven to him. "If that be treason, make the most of it!"

Second. Coming, now, to the second interrogatory, we find it is asked, "Do you have regular meetings of your faculty?" And a second section: "If so, how do you secure regularity in attendance?"

Regular coming together of those engaged in a work so complex and so important as instruction should present itself as an absolute necessity. To get inspiration from the suggestion of a colleague, and to get the bird's-eye view of the whole work which is afforded by a full and frank discussion at a faculty meeting, is indubitably of the most uplifting character. With us it is deemed right, expedient, and eminently fitting to hold such meetings, and we publish on our lecture-card a regular monthly faculty meeting.

As for the regularity, that's another story! We intend to have it next time, every time; this is not only a hope, but a solemn conviction. To this end our flag has been nailed to the masthead. As to methods of expediency, we confess we wavered between the alternatives of the old debate question, "The fear of punishment or hope of reward." Therefore, to this question we beg to "report progress."

Third. The third interrogatory reads, "How do you secure promptness and regularity on the part of your lecturers?" That, also, is a poser. We have an unwritten law that the man who habitually lags is suffering from an incurable mental obliquity or desires to throw up his job, and the law operates. We cannot pay munificent salaries, and therefore one of the essential requisites for co-laboring with us is a keen, forcible desire from within to do the work and to look above the plane of mere money compensation. We sometimes have to almost resort to hypnotism to get them, but we have not failed so far.

Again, the force of example is urged. Punctuality is not only expected and urged, but it is acted out to the letter by him in authority. The class is taught to expect it, as well as hold themselves up to such requirement. Enthusiasm is kindled by timely attention to the propriety and necessity for "getting what you are paying for, under the Constitution of the United States."

Fourth. We come now to the last question as set fort honorable committee: "How do you avoid covering t ground by two or more chairs? For example, the anatom face by the chair of anatomy and that of operative dent inflammation by the chairs of pathology and operative denti

This is dead easy. We don't try to avoid it, for seve good reasons. First: no two coverings emanating from sources are ever identical. They may be and certainly s similar, but they are supplemental reciprocally and help t each the impression made by the other. Second: The firings must necessarily occur, but the aim of the one d much from that of the other that they should not suggest ence or waste of time. For instance, the anatomist mus each portion of the organism to establish the structural di and completeness of the parts. To clearly set forth this c ness of parts he must show to a certain extent the functior part. But *function* is the special field of physiology. On t hand, the physiologist must establish the fitness of the st to elaborate function, giving the anatomy in brief of each organ to prove its ability to functionate. But this clearly upon the domain of the anatomist.

No; as we have already expressed it, let each be supp reciprocally, helping instead of hindering, and enabling the feel that the work done, not *may* be understood but *must* prehended. We must realize that there are certain fun parts and subjects and fields of scientific exposition which c be too familiarly known, too thoroughly presented, too fr repeated. It is in our work as in nature: The landscap out before us is a wonderful composite of varied interes farmer goes over it, and he estimates it according to its fi cultivation; the geologist sees only the outcroppings of va valueless deposits; the landscapist sees only its fitness or to evince the lines or colorings of beauty; and the botar over the same ground admiring or deploring the flora. Ar manner we believe each branch of our work presents ir claims which must forever demand special consideration springing from and associated with much that is commo No; we do not try to prevent intelligent repetitions, for we cannot hope to teach everything.

EXECUTIVE WORK OF THE FACULTY.

BY T. E. WEEKS, D.D.S., MINNEAPOLIS, MINN.

I DID not prepare a paper, for the very reason that I expected that what has happened would happen,—that much that I would say has already been said, and that repetition in this case would scarcely strengthen the point. I believe that the dean of a faculty should be in a measure an autocrat. I believe that the holding of office for one year and the reappointment of dean and faculty is a safeguard which will protect the interests of the faculty. I believe that the dean and the faculty should, if possible, be harmonious, and a man who can't be harmonious with his fellows had better be gotten rid of. The question I think can be answered in one sweeping statement, that if there be harmony, if the dean be the proper man to preside, to direct, and to be the autocrat of his faculty, the man to whom his faculty can look up, all these other questions will take care of themselves.

I should differentiate between faculty meetings, executive faculty meetings, and schools of instruction; I believe that a school of instruction for instructors is a necessity in a faculty because we have no normal school where dental teachers can go to fit themselves for their life-work. Consequently, they must receive that instruction from the men in the faculty who have had experience. It is for the benefit of the new men who are fitting themselves to teach, that we should have such meetings. I believe that these meetings would be beneficial if the head of each department would give a syllabus, with more or less explanation, of what he presents and how he presents it, for the guidance of the rest and for the prevention of any unnecessary overlapping.

Now, to overlap is inevitable, but there are two kinds of overlapping,—that which is necessary and that which is unnecessary,—and if each lecturer knew what was being presented by the other he would give only such overlapping as was necessary. We found it avoided friction to have each professor, or head of department, outline his work to the others, as each man gained some strength by the discussion which followed. For instance, the professor of operative dentistry gathers the instructors under him at various intervals and goes over his work with them, and in that way he is certain that the instructors under him carry out his ideas, and no

man should be a professor unless he is able to have ideas
men carry out, and no man should be a professor w
willing to accept good suggestions from his assistants
sociates.

Now in regard to the executive portion. I agree with
suggestion that it is a military organization, and in a wa
ness organization. We cannot separate the business m
the military methods from a faculty if we expect that fac
successful, but at the same time I don't think it ought to
sary to enforce a military *régime* in a faculty upon the
serve with and under the direction of the dean. I think
man in a faculty ought to have that within him that will
willing to do the right thing, and I think that every dea
possess such qualities that everyone under him will be w
anxious and will love to do the right thing.

DISCUSSION.

Dr. Geo. E. Hunt. Our method is an elaboration o
terson's method. Our professors, from the dean down
for their lecture work so much per lecture, and they sign
for a year's work, and in that contract they agree to
amount of money which they would receive for two lectu
miss one lecture and the hour is not filled. They may fil
with any other member of the faculty, but if they are sch
ten o'clock and they are not there, and the hour is not
forfeit two hours' pay. With that method in vogue w
hour last year and have lost none this year. I would rec
to those of you who are having any trouble with the
hours. The student is entitled to as regular attendance o
of the faculty as they require of the student.

Dr. H. A. Smith. All this is very interesting indee
word in reference to the attendance of the faculty.
largely depends on the habits of the dean himself.
prompt man, his faculty will imitate him in that regard.
a faculty, recalling the time when I first engaged in this
it was an exception when the faculty came on time. Let
how I attacked one of the professors. He was never kn
on time and he was always claiming that he was delayed
of obstetrics. Word came to me one morning that this

was not in attendance,—the first dash I had at him. I started immediately for the college, and about thirty minutes after time I met him going to fill his hour. I said, "It is too late for you, but I will give you the credit of good intentions this time; but hereafter if you are not punctual I will tender your resignation to the trustees at once." And I meant it, and it was said that I was the only man who had ever brought him to time. So the dean must be prompt himself and be at his post to see that his faculty are there.

Now in reference to the demonstrators. The demonstrators should be required to report when they come in and report when they leave. You can do as you please in reference to their salary. I think the New York College deducts from their salary every minute that they miss. That is one way of keeping the demonstrators up. But the dean is the responsible person. If he is not a prompt man himself, he cannot expect it of his colleagues.

Dr. J. H. Kennerly. These matters brought up so forcibly by Dr. Kirk and Dr. Patterson are matters which ought to have proper consideration, and yet, owing to the fact that Dr. Kirk's school is governed in one way and Dr. Patterson's in another, it is a very hard matter to formulate rules for the government of both. For instance, Dr. Kirk stated that his school is governed in the same way that my school is governed. The individual management of the school itself, of course, is left to the dean and his assistants, whoever they may be. And I am of the same opinion as Dr. Kirk and Dr. Patterson, that the dean needs in some particulars to be an autocrat; no question about that. We have adopted a plan this year that seems to have given us a great deal of help. In the first place, previous to the beginning of the present term, we were compelled to secure new material for our faculty on account of the resignations of some of the former teachers. The trouble we found when the work began was to unify the methods of the teachers and demonstrators. For instance, you take the professor of operative dentistry, who naturally covers the preparation of cavities and the filling of teeth; unless he and the man who teaches operative technics thoroughly understand each other it will be impossible for those men to work in harmony. We finally decided that every two weeks we would hold, not a faculty meeting, but a meeting of the lecturers, professors, and demonstrators, and discuss the different methods of teaching so as to get the demonstrators exactly in line

with the teachers. We have found that this method ena
do very much better wo.'k, with much more satisfacti
students and to ourselves, than could have been done in th
of letting every man go as he pleased.

So far as faculty meetings are concerned, we have n
time for such meetings, save two meetings a year, which
fied. We have two members, one the chancellor of the
and another a member of the Board of Overseers, who are
of our faculty, and knowing that they are exceedingly bus
do not care to take up their time by calling faculty meeti
month. We hold our faculty meetings when we deem it
and when there is anything of interest to talk about w
trouble in getting our faculty together. We have foll
method so far this term with very satisfactory results, p
the calling together of demonstrators and teachers to d
different methods of procedure in the daily course of inst

Dr. W. H. WHITSLAR. There is one question that ha
spoken of very much, and that is the relation of the profe
student. The main purpose of all of our work is to m
dentists, and in order to do that we must have a unity c
between professor and student. If we teach the students
are not there to play, but for the purpose of education
produce in them a desire to learn, and when we treat the
manner we use them as gentlemen and not as animals.
are able to promote that sort of enthusiasm that makes it
of their ambition to become good dentists. There is o
which we can produce that result, and that is to say to the
"You can appoint a committee, if you please, from you
one or two, and if anything occurs between you and the
if the professor is derelict in his duties, report it to the
officer and we will try to arrange the difficulty and mal
factory to you." Now, some professors may be very
their methods, and the class are not satisfied with the
instruction they are giving. This committee reports to
tive officer, who has a plain talk with the professor and
and thereby promotes a better feeling between the offic
college and the students, ultimately producing better i
Ofttimes things occur which the executive committee or
the college know nothing about unless they hear of it thr
student or committee.

There is another factor which comes properly within the limits of this discussion, and that is the moral relation between the professor and the students. We are not required, I believe, to look after the moral deportment of students, yet at the same time we are so much interested in them that it is a part and portion of our goodwill toward them that we exercise a condition in ourselves showing to them that we are trying to be gentlemen, thus setting an example that they will try to follow. One of the greatest advantages is the personal relation that exists between professor and student. They will return in after years and thank us for the good influence which we exercised over them.

Dr. G. V. Black. I have very little to say as to the general executive work, except with reference to instruction, and not much about that, except some things that seem not to have been spoken of. It is often necessary that the instructors in different chairs, and especially in related chairs, understand each other better than they would without coming together and discussing their mutual relations in presenting their particular subjects. If they do not do so, under the present state of things, their overlappings upon each other will become dangerous because not done in harmony. Now, mind you, the difficulty is not that they overlap, but that they overlap in such a way as to do injury. For instance, I found my anatomist and histologist and physiologist naming the coats of the intestines differently, each one presenting them under different names and dividing them into a different number of coats, destroying the harmony between them. You will see at once that this is a proper subject for all three, and yet to present such a subject properly it is necessary that they understand each other sufficiently well so that they will present that particular thing similarly to the class. Such things as this occur all through the school work. We must overlap upon each other, but we should have such an understanding, teacher with teacher, that this overlapping will be done in such a way as to strengthen the work of each instead of injuring the work of all, as it did in this case. Now, in this case I considered it necessary to call the attention of all three men to that fact, and have them come together and discuss their mutual relations and arrive at an agreement as to nomenclature, not only upon that particular subject but upon other subjects upon which they might differ,—for we may follow the literature of the subject very perfectly and dis-

agree diametrically in the nomenclature of these thing simply an illustration of what it is necessary to do w of teachers who are presenting the subjects that we tea not only occur at this particular point, but it will occur many points. Any corps of teachers in a school should system of nomenclature and understand each other nomenclature used throughout the school.

I agree with Dr. Kirk that any particular subject shou the charge of one person. For instance, operative denti be under the charge of the professor of operative den the beginning in the freshman class in operative technic of the third year or to the time of graduation, and ever that department should be in a degree under his gui what is taught, how it is taught, etc. It should be t prosthetic dentistry, and in other departments. This setting certain men to do this work without any guidan wrong, in my estimation. The whole of this work unified, harmonized, and guided by a central power. demonstrating force, it should be the same. I have for it a rule to have my demonstrating force together or sometimes twice a week, delivering a regular course often consuming a large part of the year, keeping them the work that is being presented to the students, maint mony between the action of the different demonstrators a the action of the demonstrating force and the didactic w it all moves in a unit. It seems to me that there is no c way of presenting these subjects to students. We not operative department but in the prosthetic and other as well, recognize the head of those departments as th whom we should go if anything goes wrong.

As to our faculty meetings. We have faculty meet month and the principal work in these meetings is th of methods of teaching, the presentation of this subj subject, and we have no difficulty about attendance at fa ings. Our teachers are interested in the discussion of jects. Each teacher presents from time to time his m and it becomes an interesting school of pedagogics for of the school. Our faculty meetings are distinct from strators' meetings, always.

SYMPOSIUM ON CLASSROOM METHODS.

CLASSROOM METHODS OF TEACHING.

BY N. S. HOFF, D.D.S., ANN ARBOR, MICH.

NOTWITHSTANDING the fact that the strictly didactic methods have been employed for so many years, and with such pronounced benefit, the popular idea at present seems to be centered on the objective or laboratory methods. This is particularly the case where methods of thinking and working are to be developed *de novo,* as in kindergarten work with children, or the newer sciences of biology, such as bacteriology, for instance. And these methods, for quite similar reasons, have been found the most useful in imparting instruction in the more distinctively technical branches of the medical and dental curricula. We are confident that all who have had much experience in teaching dental classes will value these methods highly, even if they do not deem them essential, in the purely mechanical or technical subjects. We have, however, come to the conclusion that it is unwise to confine the methods of imparting technical instruction entirely to the laboratory methods, and believe that didactic principles, if not methods, have an important place in presenting these subjects to the mind as well as to the other perceptive senses.

As my paper must be brought within the compass of ten minutes I shall not be able to further elaborate this statement, but crave your indulgence while I refer to my personal experience, from which I trust you may be able to draw some conclusions which may be helpful in verifying or in changing your present methods.

When I was a student, and also when I began teaching, prosthetic technics was taught as a purely mechanical art. The instructor was called the "professor of mechanical dentistry." This

condition remains unchanged in many schools at th
though most generally the instructor is now a *prosth*
separate department of prosthetic technics has cha
purely mechanical branch. Formerly the student a
lectures on mechanical dentistry and spent so much
laboratory, constructing, with the aid of a demons
experimental work as his conception of the principles
lecture course would permit.

After a short experience with this method I came
clusion that it was unsystematic and perilously faul
sides, the time given up to the laboratory part, at lea
wisely spent. A change was made in the method whi
to remove at least some of the objectionable feature
volved the separating of the technical from the dida
tion and the placing of the technical course under
structors and its more systematic development as a
nical subject while at the same time it should be made
ize and, so far as practicable, co-ordinate with the lec
on the principles and art of prosthesis.

To briefly outline the course, with which most of th
are doubtless familiar: Models which would best illu
cases were prepared, representing in a systematic g
the more useful prosthetic appliances, and from these
were made from which students might secure a uni
models for the construction of the plates and other a
the course. Each piece of work was then taken up c
and presented to the class in all the details of cons
means of a class demonstration, without discussion
practical significance, but with all necessary comment
its mechanical construction. Each piece of work was
before the class in accordance with one method only,
comment on other methods which could be sanctio
some which it was thought wise to condemn. The id
if the student could see one good method successfu
strated he would be able to copy and retain it. My
with this method has not been without criticism. It
plished practically what it was designed to do, and
satisfactory manner; it has not developed a mechan
where only a poet or fiddler was planned by the Crea

has it succeeded in circumventing the designs of the indolent or incorrigible, or any other impracticable thing. But I have succeeded in presenting to the class in an experimental way a very satisfactory amount of technical work, practically covering the entire field, in a reasonable amount of time and without increase in equipment or instructors.

There have developed in the trial of this system certain shortcomings which it seems to me might be very well made good by slight modifications of some of the methods used. I find that many students, while conscientiously following the technical instruction, have learned to follow the copy so closely that they have forgotten to cultivate personal initiative, and so when brought face to face with a practical case not resembling in most details conditions with which they are already familiar, they do not seem able to even apply processes which they have learned very well indeed. I am not sure, however, but that this result is inevitable with any system.

Another result, which while perhaps not so serious is one which is quite annoying and a great hindrance to the highest attainments, is the fact that students are apt to look upon technical work as *task work,* and so perform it in a perfunctory manner, while occasionally an unprincipled or thoughtless student will maliciously abuse your confidence. It may not be practicable, by any means, to frustrate the designs and purposes of such students, and it may not be wise to modify well-conceived and practicable methods in the hope of compelling lazy students to do their duty or unprincipled ones to do right; yet it would seem that any means which can be employed to such an end would not detract from the work of interested students, and might serve to still further increase their enthusiasm and love for the work.

For the purpose of correcting the first criticism, and to give the technical work a more artistic if not practical bearing, and of removing the seeming objection that it is an altogether elementary and mechanical task, I have this year added some features to the instruction which I hope will correct this tendency and at the same time not detract from the value of the course as a method of cultivating hand-craft. I have sought to introduce only such work as should have a direct influence in the cultivation of technique, but which at the same time would appeal to and draw out

the dormant talent, whether technical or artistic, and de
or less mental co-operation.

After the first work in the technic course has gotten
started,—and this work consists in taking impressions
compound, and plaster, each student taking the impres
his bench-mate, and pouring the impressions in plaste
three class hours are devoted to a consideration of t
anatomy of the mouth, especially the teeth and gum
occlusion of the teeth. This is done by lectures and qu
the teeth, the students having for reference the plas
which they have made, introducing as much of the no
as may be necessary to make descriptions intelligible.
of this is to first cause the student to make a more car
nation of the mouth of the patient or chum for who
work. He becomes more familiar with the form and
of the teeth and gums, and at the same time he not
ancies and strives to obtain more perfect models. Th
a perfect model in all prosthetic work is continuously
him while he is engaged in this work. As soon as thi
been satisfactorily completed each student is given
incisor, bicuspid, and molar tooth, as nearly sound as
ticable to obtain, and he is asked to carve a tooth fro
of plaster of Paris as near the form as he can and with
ings, but magnified about five times. I was quite grat
interest developed by this exercise and also surprise
results obtained. From this exercise I have gained
able insight into the intellectual and artistic capaci
member of the class. To still further test this artist
and to develop the more mechanical side of the techni
I next devised a combination steel wax-spoon and c
such lines and angles as would not only test but train a
mechanical abilities. A drawing of this instrument
urements was made and a duplicate copy furnished to
dent. The instrument was then made before the class
stration from bar steel, every step, including forging, fi
ing, tempering, bluing, polishing, and burnishing, and t
instrument placed in the laboratory where it could be ins
measurements verified. The rounded curves and definite
sizes proved a somewhat serious task to some, but the

was on the whole quite satisfactory, as the interest and enthusiasm created quite compensated for the time devoted to this work.

These exercises have served to give me a better knowledge of the mechanical conceptions and possibilities of this class than was possible by any other means; and this knowledge will enable me to present the more practical technical subjects which are to follow in a way that will draw out these same resources to the best advantage. This result, too, has been obtained without losing the confidence or interest of the class, and the work has been done in such a way that no student could shirk it and report a result to which he is not entitled.

The future work of the course will be confined to plate crown and bridge technics, and, as it follows somewhat closely the lecture course in prosthetic dentistry, there will be more opportunities for the introduction of interesting or practical incidents which will claim the attention of the students. I am planning to show before the class cases from the clinic which will illustrate the application of the various methods taught in the laboratory course. If by such means I can retain their attention and interest, I am confident that the results will be shown in a higher grade of technical skill on the part of the worthy students, and such as have little natural ability or lack of capacity for acquiring it will be easily and unquestionably found out, making it possible to discourage them from the further pursuit of a calling in which hand-craft is such an important factor. For this purpose no other course in the curriculum is so well adapted, and anything which can be added that will make it possible to get more light upon this subject will be worthy of consideration.

CLASSROOM METHODS OF TEACHING.

BY ROBERT H. NONES, D.D.S., PHILADELPHIA.

How best to teach dentistry so that the greater number will be both interested and benefited is a much more difficult question today than in former years, due possibly to the increased number of students, and greatly on account of the addition of many more theoretical and scientific subjects. The purely theoretical lectures will not meet the requirements. It would seem that the lectures

were almost supplementary to the clinics and demonst
much benefit being derived from the latter.

One individual could hardly give a proper recognit
entire course and at the same time systematize both le
practical demonstrations so that the perceptive, intellige
could be as advantageously instructed as his weaker
But the combined thoughts of many, collected from car
vation and association with the student, naturally wo
best method of solving the problem.

Careful systematizing of methods, division of classe
tions as well as thorough instruction of demonstr
structors, and lecturers by the professors of the vari
always maintaining a very close and friendly relationsh
professor, instructors, and students, permitting absolut
rier between them,—the one thought being entirely,
best benefit or be benefited, and how?—is the first ste
successful result.

Why were so many of the older practitioners such
dentists? Principally, because of their tutelage under
who commenced with them at the bottom of the ladde
atory work, and by practical observation and apprecia
ually made them masters, not only of the mechanical
the piece in hand, but gave them as well a thorough
of the make-up and use of the materials, tools, applia
of which and with which it was made. The learner
familiar with dentistry at the bench that operative dentist
a natural consequence, and he could almost teach himse
trast, I might say, with the desire of many who have en
the study of the profession in later years (beginning
of the ladder!), to work at the chair and gradually
ward toward the foundation. Such a course is rarel
ful toward the making of a thorough dentist. As a g
the student who attempts to learn the operative bran
the sacrifice of the prosthetic, rarely becomes a good
but those who begin at the beginning,—the bench, w
pleasant or unpleasant surroundings, according to the r
trary to the mistaken idea possessed by many who be
their tutors left off with fashionable practices, almost
become good all-round dentists.

Those of us who have seen the past method of teaching, when the student usually entered a laboratory for a few years preparatory to college, cannot but question, Are we to-day making as good practical men, or do we sacrifice some of the practical for the theoretical? It is a matter of grave importance not only to teachers but to the coming generation of dentists. We must at this enlightened day have theorists; how much, if any, of the practical side can be sacrificed, or what happy medium can be reached? is the problem.

If all the colleges were so fixed financially that applicants could be received or rejected at the judgment, say, of the teacher or teachers of operative and prosthetic dentistry, I unhesitatingly affirm that the successes would be more numerous and the failures less, because they would naturally select students endowed with mechanical instincts, and who being thus armed would be better prepared to acquire theory.

What chance would a prospective student have who had never as a boy driven a nail, sawed wood, or made his dog a house? Given students with mechanical ability, we can make dentists; without it, failures. We may be mistaken, however; manipulative ability can be acquired, but it is the exception rather than the rule.

How best to teach in colleges having crude untrained material, with, in many cases, absolutely no instruction from preceptors, in order that many, instead of a few, may be benefited, will tax the brain of the most experienced teacher. One assuredly feels, however, that if started with a proper foundation and agreeable surroundings, the work will not only be interesting, but a pleasure to perform. So in teaching, the student at the beginning should be brought to a thorough knowledge of the laboratory and its equipment, not only theoretically but practically, the instruction never being entirely by lectures, but rather the reverse as far as possible,—by practical demonstrations.

The lecturer cannot get too close to the student, in fact he must be demonstrator as well as professor. Greater interest is retained by not leaving the practical side entirely to the demonstrators or assistants. The student should be thoroughly taught theoretically how it is done, and practically how to do it.

Sectioning off classes cannot be too strongly commended,—strengthening the student where weak, and making him stronger

in those points which he seems particularly able to g
advancing the capable and holding back the tardy u
proficiency has been attained; but the advancing of the st
one step to another before he is thoroughly trained sho
demned, although to give him proper encouragement is
tial.

I have had increased success by following up lectur
thetic dentistry, within the next day or so, with demonst
students duplicating as closely as possible the work pe
all requirements being personally made before the st
ing him much better instruction than it is possible
from lectures, or from finished or partially finishe
models.

Too much praise cannot be given the lantern metho
ing in all branches in which it is practicable, and it *is*
some extent in all. In order to realize how much stud
benefited by this method, we have only to reflect how n
we grasp the words of a speaker when able to see
placed in a picture.

To set aside part of the lecture-hour for quizzing wi
to be advantageous not only to the student, but to
as well, giving him an opportunity to find out whether l
has been clearly and correctly understood, and to set
who may have misunderstood or who were not clearly

Many of us forget that it is impossible to make o
too plain or simple for the comprehension of the gen
body. We are too apt to talk over the heads of ou
we should always endeavor to have each individua
room feeling that he has been benefited in at least on

The teacher who has the ability to draw, and there
his lectures or talks with sketches, can not only clea
but interest his class, as well as hold their attention. T
is much to be preferred over that of presenting ol
brought out year after year, and which have become
to both teacher and student.

The more demonstrative are the teachings, the
students are able to grasp them, and the more enth
played by the instructor the greater will be the inte
class, particularly in those subjects which so many f
direct bearing on dentistry.

A systematic course of lectures, each followed as far as practicable with clinics and demonstrations, will be productive of much good; as, for example, in operative and prosthetic dentistry each lecture should be followed with clinics or demonstrations,—the chair of pathology and therapeutics affording an excellent opportunity for sectioning off the class for practical demonstration in the infirmary of the college.

Surgery offers a course, particularly with work upon the cadaver, which is not fully appreciated; the students should assist in and perform such operations as are calculated to be of special interest to the dentist.

In anesthesia and anesthetics they should not only be shown and assist in the actual demonstrations, but be allowed to perform the various methods; in this connection a thorough course on physical diagnosis, with practical demonstrations in which the student should take part, will do much to correct the ignorance displayed on this subject, and protect patient and operator as well.

So with the various other subjects,—practical demonstrations, close association between the instructor and instructed, encouraging and enthusing the student to a thorough conception of the truth that "What is worth doing is worth doing well."

With the coming four-years course an opportunity will be afforded the teacher for a still more thorough course of demonstrations, and the way opened for the better teaching of particularly the practical branches.

CLASSROOM METHODS OF TEACHING.

BY L. S. TENNEY, D.D.S., CHICAGO, ILL.

THE problem of classroom teaching is one that has received a large share of the attention of this body, for next only in importance to the question of what studies should constitute a complete dental curriculum in order to afford the most thorough and efficient course of instruction is the problem of presenting those subjects in the most effective manner and in a way that will result in the broad-

est development of the student and best fit him for the
his work.

In a paper so limited as this I cannot attempt othe
random thoughts, and as a teacher in the operative d
our work it is proper that I should confine myself to th

The laboratory method of instruction is a developm
years, and is rapidly finding a place in nearly every d
our college work. In materia medica, anatomy, phy
bacteriology not only is a large amount of illustrative
made use of, but more actual laboratory work is req
student than ever before.

We need hardly discuss the merits of this method
its value is too obvious, and it has become too fully r
us all. It is to-day, and must ever remain, the mo
feature of our educational system; and the only ques
proportion of our time may be justly allotted to such w
tive technics, occupying as it does a most important
tween the theoretical and the strictly practical, and co
two, should, in my opinion, receive a larger share of
than it does at the present time.

In the use of these terms, however, I wish to say
much impressed with the position taken by Dr. E. C
paper read before this Institute a few years ago, in w
exception to the common expression, "practical and
when applied to dental teaching. He contended tha
embraced no subject whatever, if I understood him co
could not be regarded, in its broader sense, as practic
the long-established custom of designating studies as
theoretical, according as they relate or do not relate
technical procedures, has fixed rather a clear line o
between them; and it is in this sense only that I use th

But with reference to the teaching of operative tec
that we not only do not do full justice to the subje
braced in this course, but that other and most useful
be added. We are to-day carrying this teaching but
than we did when the course was first introduced,
will be admitted that our methods have greatly improv

time. That we have kept it within its present limits has been to a great extent a matter of necessity, since the length of the college course would not permit any material broadening in the scope of the work; but when a four-year curriculum shall have been inaugurated, that curriculum should include an advanced course in operative technics.

If I were asked in what particular the work should be enlarged upon, I would state that in my opinion we should not only require more extensive experimental work with reference to the character of all structures operated upon, and the physical properties of all materials employed in these operations, but that the proper place to teach first-year operative dentistry is not in the lecture-room, but in the laboratory, where lectures upon this subject might be amply illustrated and be supplemented by laboratory drill.

To me, this method of teaching operative dentistry would appear to be the logical outgrowth of our many years of thought along the lines of technical training, and, in the light of past experiences, the time seems ripe to transfer this whole subject from the lecture-room to the laboratory until the student has mastered all the technical details possible and is prepared to enter directly upon his infirmary practice, thoroughly trained in every phase of operative work. Limitations it must have, since laboratory practice can never take the place of practice upon the living subject; but in the former there is still opportunity for much improvement, for we have by no means developed as yet all the possibilities of training of this character. Mere knowledge of detail, however, is not the only benefit to be derived, for in the laboratory only can the student acquire that manipulative skill that will enable him to successfully prosecute his infirmary work; and to this end his technical training should not only be made more thorough and comprehensive, but should immediately precede infirmary practice. I can make only this brief reference to the matter, however, and hope to hear some expression from you in the discussion of these papers.

On the subject of laboratory teaching in general, I wish to say that to me there has always appeared to be a tendency on the part of the student that we must early endeavor to correct,—a tendency tc do his work in a mere imitative way. If, for example, he is preparing a cavity in a tooth-form, he follows the demonstrator closely, observes his method, inspects the cavity he has prepared, and, hav-

ing noted its exact position, its form and its dimension to copy it with little or no thought of the principles inv works by rule and subordinates principle to mere deta

That method of technic training is most effective wh principles and then encourages the student to reason ou plication. Every opportunity possible should be afford instruction, since all authorities agree upon this to-da the most rational system of education. The very chara work demands originality in thought and action, and should be constantly directed toward its development. should follow his demonstrator intelligently, but not must be guided, but should not merely imitate. S should be encouraged from the start, knowing, as we future success will depend largely upon his own indivi ment. The reason for every step and the principles invol be made most emphatic. To know why cavity margins beveled, and why cavity walls should be extended, is greater importance than the mere technique of those Not that I underrate the necessity of exact technical tra once get the underlying principles implanted in the min man can solve the problem of detail for himself.

Again, since the knowledge we acquire through ou periences and through scientific investigation is of the g most permanent value, more time should be devoted to w character. All other methods of teaching are fast giv that more rational system where knowledge is based statements of accepted authorities, but upon carefully scientific facts. Indeed, we have long recognized and a this system, although we are not as yet giving it the a importance demands; and it is along this line that w enlarge on our laboratory work. The field is wide and tunities would appear almost unlimited.

Gold in all its forms should be studied experimentall ditions necessary for perfect cohesion, the effect of illustrated, its behavior under pluggers with serrations depth; tests applied to determine density and resistanc with experiments illustrating clearly the results of adaptation. The study of amalgam should be carried same practical manner, showing its tendency to change

subsequent tests for leakage; the right proportion of alloy and mercury, with tests for density and edge strength. The study of cavity preparation should be most exhaustive and largely experimental in character, illustrating the mechanical laws involved, determining the degree of resistance offered by fillings, and demonstrating the various methods of instrumentation.

In short, this method of experimental teaching should in a large measure supplant all others, for it is evident that a student possessed of the knowledge thus acquired has a clearer conception and a firmer grasp of the facts than he could possibly gain in any other way. He is brought to realize clearly that exact scientific knowledge must be the basis of his work.

In the consideration of teaching methods it would seem proper that I should call your attention at this time to a new feature in the construction of the flexible rubber dummy. The introduction of this dummy marked a distinct advance in our technical work, offering as it does possibilities scarcely thought of before. The dummy as presented here to-day does not differ materially from those presented at previous meetings by Dr. Webster, Dr. Byram, and others, aside from the method of obtaining the vulcanite teeth.

In a number of colleges the method practiced heretofore has been to require each student to carve a set of teeth in vulcanite or other suitable material; and while not wishing to be understood as criticizing the work of others, I will state that my own experience has been that the carving of these teeth involved the expenditure of too much time and effort, and offered too many technical difficulties, to be practicable. That the carving of a full set of teeth would be an excellent training no one would deny, but the question arises as to whether the results secured would be in just proportion to the time required. We are endeavoring to make our course as thorough and comprehensive as our time will permit, and we must not devote too much attention to any one feature at the expense of others of equal importance. The carving of four, or at the most, six teeth, therefore, is all that I have ever felt justified in undertaking.

The problem of securing molds in which teeth might be vulcanized was suggested at our last meeting by Dr. H. J. Goslee, and since that time the matter has been taken up by Dr. C. F. Bryant, who after repeated experiments and discouraging failures,

finally produced a set of molds with the results as sho
day. These teeth, finished and ready for use, are nov
the students at nominal cost. They are then arranged
the model properly carved and covered with heavy t
which the case is flasked, packed, and vulcanized. I h
this method in this year's course with the most satisfac
Out of the entire class there has not been a single fa
construction of the dummy, and a wide range of de
work has been made possible.

In the early part of anatomy teaching I hold freque
written quizzes, requiring that all note- and text-bo
aside, but allowing the students to converse freely. W
how timid the beginner is in the use of technical te
method familiarizes him with the use of such terms, i
fidence, and for this purpose, if for no other, has proved

Instrument-making is limited to about a dozen or f
forms, feeling that with the present length of the cour
further than this would require the outlay of too much t

In ivory carving we use no measurements except
dimensions. As the piece begins to assume definite fo
pers are discarded and the characters of the tooth are ju
eye alone.

In the teaching of cavity preparation, after discuss
rules and requirements, and when some practical wo
done, I suggest the position and approximate outline
cavity, and then require each student to prepare su
with nothing to guide him but his own conception
form should be. It brings out a discussion of principles
else will.

The work of the course should be arranged and cla
reference to its bearing upon the more closely related su
the view of employing as many methods as possible
each subject considered. Carving should be done
teaching of anatomy, and root-canal technique should i
follow. Instrumentation should begin with cavity prep
be continued along with it. System and intelligent a
is of the utmost importance, and should be observed th

DISCUSSION.

Dr. Ellison Hillyer, opening discussion. I do not understand from any of these gentlemen whether or not they have found it advisable to divide the class distinctly. Dr. Nones has spoken of it, but I do not know that he does it. We in New York find it very advisable with a large number of students to divide the class into distinct sections and by this means—in classes of from ten to twenty—the professor and his assistants are able to take each man individually and follow with him each particular step. The difficulty of which Dr. Hoff spoke, that of students having their specimens made by someone else, or by someone outside, has been done away with entirely by the system of cards which we have in every class and in every section. These cards have upon their back, as I remember, a full list of the steps in all the work, and on the face a place for the student's name and section, with corresponding numbers to the steps on the back and as each student finishes a step he has to have his card and the one which the instructor holds, which is a duplicate, punched together.

The matter of demonstrating coincidently with the didactic work we have followed, at least in my department, by having such work demonstrated at the lectures. The personal attention to the students is what we have been most anxious to bring about, and seems to have been accomplished by dividing into sections.

Dr. W. E. Grant. There is one point that I wish to especially emphasize, which we have used in the Louisville college, and that is the suggestion of the advanced operative technics course, and as the colleges are about to advance to the four-year course we can probably use it to better advantage than in the past. We have a course that is required of the junior students, covering about thirty to thirty-six hours, in which they review much of the work of the freshman year, as juniors, just prior to their going into the infirmary. Those of you who have not tried such a course would be very much surprised to see the results,—how poorly even those students that were well advanced as freshmen understand operative procedures when they return to you as juniors, especially if they have been out of touch with dental work during vacation. This course puts a student to task to show you how much better he can do his work as a junior than he did as a freshman, and some of the operations required of him in the freshman course are also required

of him in the junior course, and he is criticized and g
carefully on these operations. This course is very ben
I think some of the technic teachers who have not trie
be delighted with it after a trial.

Dr. T. E. WEEKS. I want to support what Dr. W
last, or rather to modify it a little by calling the attenti
of you who were at the Columbian Dental Congress
cussion of Dr. Cattell's paper. I made the statement a
that the technic of the dental engine should be taught a
time that the technic of other instruments was taught, ar
it now more firmly than then. What would you thinl
penter who compelled an apprentice to cut a mortise w
without the aid of an auger, and why do you refuse the
use of his dental engine on his technic work and compel
it with hand instruments? Why should he not learn
of the bur and the handling of the handpiece at the sa
learns to handle a chisel and excavator?

What I wanted to detail was an experience we have l
verting the infirmary for several afternoons into a clas
an infirmary drill for students who had successfully com
operative technics and were ready to be admitted into the
There are still some things that a student has to learn,
awkward and embarrassed in the reception and handl
patient,—namely, the reception and seating of the patie
justing of the chair to the patient, the examination of
the adjustment of the napkin, and the use of the mouth-
exploring instruments. The first operation that a stud
mitted to perform is the cleansing of the teeth, after th
tion. First, he is required to examine the teeth and note
the operations necessary; second, to cleanse the teeth t
remove all calcific deposits, and thoroughly polish the te
there is another operation which is very important, and
adjustment of the rubber dam. We divide our class in
two, or A and B, as you please. Mr. A takes Mr. B an
him as a patient, seats him, adjusting the chair to his co
to his own convenience; examines his teeth with the aid
plorer, the mouth-mirror, the floss silk, the glass of t
and syringe, and notes on the blank the condition of Mr.
When all of the Mr. A's in the class have completed tl

takes the chair and Mr. B does the same thing for Mr. A. Then Mr. A cleanses Mr. B's teeth, and in turn Mr. B cleanses Mr. A's teeth. Then they apply the rubber dam in at least three different positions. They are taught to measure the rubber dam, how much rubber dam to use, where to put the holes, how far apart to put them, the value of floss-silk ligature for carrying the dam into position, and the value of twisted ligature for retaining it in position over the floss silk; where clamps are necessary, and where they are unnecessary; under what conditions it is necessary to have a retaining ligature, and under what conditions it may be dispensed with. The teacher of operative dentistry and all of his assistants are in the infirmary during this drill, so that there are enough teachers to instruct and watch each student to see that he correctly performs the task. And we find that when the students approach a patient they do it much more intelligently.

Dr. H. C. Kenyon. I believe that the teacher should come into close contact with each student and that the person who gives the didactic instruction should, if possible, be in the laboratory to assist in the demonstration. I am especially interested in operative technics and I have been particularly interested in Dr. Tenney's paper. My method of teaching is to use the usual laboratory methods in the preparation of cavities, carving of teeth, and making of instruments and teaching of instrumentation; and I find that it is quite advisable to give what I call a laboratory lecture,—a short talk of perhaps not over fifteen or twenty minutes at the beginning of or some time during the laboratory period, and I expect to keep to the subject immediately in hand for that particular afternoon. Sometimes I make an outline explanation, using the blackboard, and illustrating on models. I make a thorough explanation of the work that is required, and then I see each man personally and help him to carry out the instructions, and I think that I have been more successful with this method than when I have to depend upon giving the lectures at one time and the demonstrations at another. You tell students from the platform what you expect them to do in the way of making a technical piece, and there are so many small details that their minds will not carry them for any length of time; so I think it is very important that the student should have a clear, concise outline lecture and demonstration of the work and then that you go directly to him and assist him,—I mean, to point out his

errors and make corrections in his work and guide him
struction of it. I have used this method, and so far I ar
pleased with it.

Dr. A. E. Webster. I have had a great deal of
listening to Dr. Tenney's paper. I do not wish to discu
ject to any extent, but I desire to draw attention to o
show the difference between didactic teaching and labora
ing, I mean in efficiency. I have taken about forty
room and shown them as definitely as possible how to
on a broach, explaining it as explicitly as I could, and th
them to try it. It is surprising how many men will f
oughly grasp what was said. I have often made a wa
class and said, "Well, I have just demonstrated this to
find twelve men out of the forty who cannot do it."
twelve men out of forty cannot do it, how would you e
to remember it for a year, as is the case in some colleges

The other point I want to draw attention to is in th
operative technic work. Last year I drew attention to
engine technic. I want to say again that it is just as e
a student to have engine technic as any other kind. Thi
ing to a patient a student who has never handled a
This may be done, and should be done, just previous to
ing the infirmary, so that a student may make the very
in the technic department that he is called upon to do
firmary. The operation that he has to do the next d
patient he may do in the technic department, using
models that have been referred to.

Dr. D. M. Cattell. I would like to know what Dr.
anyone else, would think of the foreman or boss of a
who would put an apprentice to work at making a box
tailed joints the first thing he did when going in, or at
acter of work before he learned how to drive a nail
common, plain box with saw, nails, and a hammer. No
right for that apprentice to learn how to make boxes
tailed joints, but not until he has learned how to drive a
hammer. Expert work is not done with unskilled hand

Dr. T. E. Weeks (Replying to Dr. Cattell). If I h
in one classifying phrase that I neglected to use, my eloq
would not have made that speech. The use of instrume

be taught sequentially, and I did not think it necessary to make that statement to this body of men.

Dr. V. E. Barnes. In my college training, both in the technical and dental schools, it seemed to me that the students are not brought to understand the relation between their technical and their practical work. The one does not merge into the other, *i.e.* a man is set to work to make a fine technic plate; it is fine as a technic piece and there it stops. Then he goes into the clinic and is asked to make a practical piece. He can do the technical part, but knows nothing whatever of the fitting of that piece to the mouth. It seems to me that with the soft rubber dummy we can more closely imitate nature than in any other way. Prosthetic pieces can be constructed on these dummies and then be fitted to them. Here the use of the dental engine should be taught, for surely the student should understand its use before experimenting on a patient with it. As a student, trained in a college and under a preceptor I must say that the college training was technical and the preceptor's was both technical and practical.

A word on making the soft rubber models. When I first made them I was surprised what a field they presented in teaching dental anatomy, for I learned a good deal of it before the models were finished. By using natural teeth in plaster molds, the hard rubber teeth thus obtained are somewhat crude and need carving and polishing a little. This I believe is just enough to give the student a good idea of the tooth it represents. When these teeth are finished they can be mounted on the soft rubber base on which the technic pieces can be made and fitted.

Dr. T. E. Weeks. I attended a meeting of the Minneapolis Educational Association and listened to a paper by a teacher of manual training; there was one point in it that struck me as being of direct practical utility to us as dental teachers. Possibly some of the rest of you have experienced the difficulty of having one or two bright men get through their technic tasks before the rest, and it upsets the course badly to allow those students to go on to the next step before the rest are ready. He obviates this difficulty by selecting an extra task that the brighter men may do, and it is rather an incentive to all of the class to complete their work quickly. I will explain it by describing a windmill which was being made. The teacher would not allow each man to make a

windmill, but he allowed the men that got through to pieces of the derrick; then each man made a vane for and the best one was used to be mounted on the derric the combined effort of all the class. It struck me th utilize this idea by having some advanced pieces of w pieces of work that the students might do, and they wo and glad to get through their work in order to perfor piece of work.

MANAGEMENT OF THE INFIRMARY CLINIC IN DENTAL SCHOOLS.

By G. V. BLACK, M.D., D.D.S., Sc.D., LL.D., Chicago.

In the consideration of the management of the clinic of a dental school we should have a clear appreciation of what is to be accomplished, and of the natural or artificial hindrances to its fulfillment. The object of the infirmary clinic is the education of students in the practical features of dental practice. Every arrangement of whatever nature should be made with the view of contributing to that end. In doing this, however, many side issues come in for consideration that will not down without serious evil to the educational interest, and that must be worked out in such a manner as will, all things considered, best conserve the interests of instruction. One of these is the financial interest. At the present time the income from the clinic is regarded as essential, probably, by all of our dental schools. Having said this much, I shall not discuss the matter further except as to arrangements for the incidental collection of these infirmary fees.

Another matter in this connection that might well be the subject of a separate paper is the arrangement of the course of instruction in operative and prosthetic dentistry with mutual reference to the didactic and the clinical instruction of students. It is in this that many of our dental schools are lame. But as other things are expected of me in this paper, I cannot now stop to discuss it further than to say that the whole of the teaching of either of these departments should be under the control of one person from the beginning of the freshman year to the close of the senior year. I do not mean by this that one person should do all of the teaching in either of these departments; but I do mean that one person (or, it might be, several in consultation) should plan all of the teaching in either de-

partment and have constant jurisdiction over the prog
work in all the grades, to the end that the teaching in
presentation be a continuous whole. No one teacher sh
different nomenclature from another. No one teacher in
grades of operative or prosthetic dentistry should teac
that will be dropped as superfluous in the next class, no
ner that will not be followed by the next teacher wh
class. This holds good in all respects whether the teach
or many, whether the students be few or many, and in
demonstrating force in each department; no matter if th
composed of one person or of many persons,—all must ac
as a unit as possible in order that the best results may b
All of this is necessary to the best results in the infirm
especially is it necessary that the demonstrating force be
in their work that they may follow closely the didactic i

With these statements I shall leave this part of the s
proceed to that which seems to have been more especiall
for the subject of this paper: The *management of th
clinic with reference to its records.*

One of the first things now to be considered is the leg
the college student in the clinic. In the legal sense the s
no rights in the practice of dentistry except as he is dire
structors who have acquired that right. His instructor
him in the position of legal guardians of all of his rights
Therefore the student can do nothing in practice, legall
the direct oversight of his instructors. This is true of t
in the office of the practitioner as well as in the school.
being conceded, the first care will be to make such arrang
the infirmary clinic that every patient comes first into th
an instructor for the examination of the case and the firs
of the student in its treatment. From this point to the
charge of the patient each step of the operations perform
under the guidance of the instructors. This is just as n
the educational sense as in the legal aspects of the case, a
reason that the student is to receive instruction upon p
point as he proceeds. The whole arrangement of the c
be made with both these ends in view. These should pro
record of each step in the procedures in such form that
can be brought in review at any time after the operation

pleted, showing that this guard has been kept in each individual case. This kind of guardianship is necessary in the legal sense for the protection of the school in case of any suits for malpractice in its clinic. If this care is clearly shown the courts will be very slow in finding against the school; but if, on the other hand, it should appear that this care has not been exercised, such a case might easily result in heavy damages against the school; for the decision in the case would hinge largely on the question whether or not reasonable care and supervision had been exercised by those in authority. This is also necessary in the educational aspect of the case in order that the education of the students and of each one individually may proceed in a systematized way, and be guarded at every point. None of this should be left to the memory of either instructors or students, whether the classes be large or small.

What should be the record of the steps of procedure? or at what points in the procedures should records be made? As far as possible these should be selected at natural breaks in the procedures, or where changes are made from one part of an operation to another, and especially points where the student will require other material in order to continue, and to obtain which he must consult his demonstrator. All such points should be made landmarks past which students should not go without consultation, for they are sure to take matters in their own hands and proceed if not rigidly estopped. Take, for example, operations for filling teeth. I should require these. First the examiner determines approximately what filling operations are needed for patients individually as they present themselves, and makes a record of his findings in duplicate upon an *assignment slip*. One copy is filed under the student's number in a filing case kept for the purpose, and the other is delivered to the student to whom the case is assigned with some general directions as to its treatment. In making this assignment the examiner has due regard for the difficulties of the case and of the competence of the student selected to handle it. The possession of this assignment slip is the evidence of the student's right to operate for that patient. With it and the patient he enters the operating room, either at once or at some subsequent time as may be arranged, and also from time to time as may be necessary, for it is not necessary that the patient go again to the examiner.

Having placed his patient in the chair he makes his own examina-

tion, comparing his findings with those of the exa
possibly chooses his course of procedure for that sitting
calls his demonstrator for advice and is in frequent c
with him from that time to the completion of the operat
as the demonstrator cannot be always at the student's sid
not desirable that he should be, it is necessary that ce
or hindrances be imposed to his progress past certain p
out examination of what he has done, to prevent the stu
matters too much in his own hands. Therefore no mate
be obtainable for making the filling except by order of
strator in written form, requiring that he be called for th
Then the preparation of the cavity must be examined and
or such changes ordered or demonstrations made as wil
approval. Then the student's *record slip* is made out
proval of the preparation of the cavity recorded with
strator's signature. At the same time an order is m
which the student draws the necessary material from the
lecting the price from the patient and paying it to the c
it being receipted for by the cashier by punching the figu
patient's receipt which is attached to the operative
Note now that the material is drawn upon a special *ord*
must bear the number of the record slip upon which it
The two must be presented together at the office. The
remains at the office and its duplicate with the demons
from these the financial record is made. The recor
patient's receipt is retained by the student, with the cred
the cash paid upon it. Then he can proceed with the
such consultation as may seem necessary. In case large
are being made it is common with us for the demonstra
but a part of the gold necessary on the first order,
student may not escape inspection at a point during the
the work, and also because of the difficulty of choosing
the right amount of gold.

When the filling is finished the student is estopped
charging the case until the demonstrator has examined
upon it, has graded it and awarded the points credit to
and made the record on the *record slip*. This amounts
lute hindrance to passing the demonstrator at this poi
this record slip turned into the office upon which the stud

credit for the minimum requirement of operative experience in filling operations before graduation. If he discharges his patient without this examination he receives no credit. This should be positive in all cases and without the possibility of evasion. When this is all completed the receipt for the money paid is detached from the record slip and handed to the patient, who is discharged for the day. The record slip is then returned to the record clerk to be recorded on the student's record page.

This completes the individual filling. Every other filling operation is like it except that one assignment is all that is necessary for the consecutively arranged operations for one patient. For this four slips are necessary; and these may be on the personal plan or on the numerical plan, as will be explained later.

The first is the *assignment slip,* which should be made out in duplicate, the examiner filing one under the student's name or his number, and delivering the other to the student. No student is allowed to operate for any patient without displaying this slip, which is the evidence of his right. In every class of a considerable number of students some will be found who do not get along well with their patients, and as a result the latter disappear from the clinic before the work assigned is completed. Such students invariably complain of a lack of patients for whom to operate. In any case of complaint a comparison of the assignment slips filed by the examiner with the credits to the student on his record page will expose the true nature of the difficulty.

The second and third are the *operative record slip* and the *patient's receipt,* which are attached together until the completion of the operation. This record slip is necessary, with the record in due form, from which to make up the student's records of experience in operating, without which in satisfactory amount no student can graduate. This should bear on its face a record of the individual cavity, the approval of the preparation of the cavity, the amount and kind of material ordered for the case, the points awarded for operative experience, the grade of the completed work, and the initials of the demonstrator who had it in charge; all of which will be posted upon the student's record page.

The fourth is the *operative order slip* from which the finance account of the clinic is made up. This is also in duplicate and has consecutive check numbers. One copy is given to the student on

which to draw his material, and the other is retained by the demonstrator and turned directly into the finance office at the close of the day. The finance clerk compares these with those on which the students have drawn their material, to see if all has been correctly done and that the cash agrees with the amount the slips call for. We have found this necessary to prevent some evil-disposed students from imposing upon the clinic by collecting from patients, using their own material and putting the money in their own pockets. By this plan any attempt in this direction is at once detected, accurately located, and the guilty party immediately exposed.

The *student's record page* is a page set apart to the individual student in the operative record book. The same book is also used for the prosthetic records, and it is our custom to place the two pages opposite so that opening to one displays both. These pages have ruled columns for each item of credit to the student on the record slips, in which these are posted in full, with the name of the demonstrator having the oversight of each case, etc., making a concise but very complete record of what has been done.

Prosthetic department. The *assignment slips* should be the same for both the operative and prosthetic departments, but the other slips should be different because of the difference in the credits to students, the difference in the material required, and the difference in the plan of collecting the fees in the two departments. To place all of these on one slip so as to use the same for both would make it unnecessarily cumbersome. Neither can the collection of fees be managed in just the same way, for the reason that the student will want material at times when the patient is not present. This makes it necessary that some fixed portion of the fees in this department be deposited at the beginning to prevent loss, and that this be arranged for each case, with the proper record. Otherwise than this, the same principles should control in making out the prosthetic record slips as have been explained for the management of the operative department. That is to say, stops for examination by the demonstrator should be imposed at every natural change in the procedures, whether the piece be a crown, a bridge, or a plate. In the case of an ordinary Richmond crown these stops may be at the time the root is prepared and an order slip is to be made out for the gold for the band; when the band is fitted and the gold is to be ordered for the cap, and the tooth selected; when the tooth is

ground to place and the gold is to be ordered for the backing; and the rest on a similar plan.

Each one managing such a department would naturally have his own ideas as to just where these enforced stops for examination and special demonstration should be placed; and I do not know that the placement of these has any special bearing on the general management so long as they are sufficiently frequent to prevent students taking matters too much in their own hands and getting out pieces of such work without sufficient supervision and demonstration for their proper education and the needful protection of the interests of infirmary patients. But it is the duty of every school to see to it rigidly that such arrangements be made as will subserve both these interests.

The particular wording upon the slips will of course depend upon the ideas of the different instructors having the departments in charge; and particularly upon the credits arranged to be awarded to students, and the material that is supplied them by the school. I do not mean that these are matters of indifference, but rather recognize that in the present stage of the development of dental educational methods it is too much to expect that the various dental schools will agree on all of these points. Harmony in these matters is, however, very desirable, and it should be the object of all those interested in dental education to enter into the discussion of these plans with the view to the development of a system that can be generally adopted in dental school work. The cardinal points which I have tried to illustrate thus far may be named as—First, such checks as will bring the student sufficiently often into consultation with the demonstrator to well serve his educational needs. Second, such checks to the progress of the work without supervision as will well protect the interests of the infirmary patient from questionable procedures by students. Third, the keeping of such records of these procedures as will serve to bring in review each individual case at any after time and show to any court of law that the interests of both student and patient have been duly guarded at every stage of the operation. Happily these coincide in such a way that when the one is well done the other two will also be cared for; they are coincident interests. No dental school should do less than this; for this much is necessary to the proper guarding of the education of the student; this much is necessary to the proper guarding of the

interests of the infirmary patient, and the records are necessary to show that these have been well done, and to protect the school against damages being awarded in case of suits being brought for fancied wrongs to patients.

Some other records are necessary to render these complete under all of the conditions that are liable to arise in the progress of the work in dental schools. Patients will come with complaints having forgotten the student's name, and no one may remember about the case. Students will occasionally lose their assignment slips, and will have forgotten the name and address of the patient. Patients occasionally come to an engagement having forgotten the name of the student and no one knows whom to call. Indeed, all manner of crooked things will come up that require immediate disentanglement. The best scheme for this is the patient's *index register*, if the personal plan is used, or the patient's index register and the ***numerical register***, if the numerical plan is used.

The best patient's index register by far is the *card index*. In keeping this, the examiner writes the name and address of the patient on an ordinary catalogue card, adding the name or number of the student to whom the patient is assigned, and files these alphabetically in the ordinary filing case. During the work of the day these cards may be set away as they are written, and filed in order in the case after the other work is over in the afternoon. When both the name of the patient and the name of the student is written on all of the slips and on the student's record page, consultation of this index will serve as the key to the whole account whenever the patient's name is known. In case the patient is to be found, the student's name being known, the name will be found either on the student's record page or on the assignment slip filed by the examiner.

This personal plan requires that the name of the student, and the name and address of the patient, be copied from slip to slip throughout all of the procedures, and finally upon the student's record page. It is desirable that this be avoided, and the amount of writing reduced to the lowest amount consistent with accuracy in the accounting; this is best accomplished by the numerical plan. In this the patient's index card is the same, except that consecutive numbers are printed on the cards, and in writing these they are taken from the pack in numerical order. Otherwise the patient's

CHARGES.

Gold fillings,	rolls	Gold, per roll,	$ .25
Amalgam capsules		Each,	.25
Cement orders		Each,	.10
Scaling teeth		Each case,	.25

CHARGES.

Gold Shell Crown, $4.00.
Richmond Crown, $4.00.
Porcelain Crown, $4.00.
Banded Logan, $4.00.
Plain Logan, $2.50.
[illegible]

Gold Plate, from $20.00 to $40.00.
Aluminum Plate, $7.00 to $10.00.
Vulcanite Plate, $5.00 each.
Partial Plate, $3.00 to $5.00.
Gold Clasps, $1.00 each.
Continuous Gum Plate, $40.00 to $60.00.

name and address and the student's number only is written on the card as before, and the card is to be filed in the same way. But in this, the number of the card becomes the number of the patient, and takes the place of the patient's name and address on all of the slips and on the student's record page. Otherwise, all of the slips and the student's record page is the same as before; no other change need be made in them whatever.

This plan saves a large amount of writing, for we have found that by the personal plan the name and address of the patient is written from seven to eleven or twelve times for each operation. In the numerical plan it is written but twice, and afterward designated by number. But in the use of the numerical plan, a ***numerical index register of patients*** should also be kept. This is the ordinary book with the ruled lines consecutively numbered, used by commercial houses that use the numerical plan of book-keeping. In keeping this book the examiner writes the index cards and sets them away as before during the busy part of the day, but before filing them away he copies the name and address upon each card, with the student's number, upon the appropriate line in this numerical index book. Then when it becomes necessary to look up the name and address of any patient for any purpose, the number being known, it is quickly found by reference to this book. I am of opinion that this is the most complete system of book-keeping for the dental school clinic that has yet been devised, and will on the whole best subserve the needs. With this, if any fact is known of any given case, all of the records of the case can readily be brought in review.

I suppose, with many, the question will come, How much of this book-keeping can be left out and still leave a sufficiently complete record? About all I can say is that this question will have to be answered by each school for itself. I know that the records of many of the schools are very incomplete at the present time, and are sadly in need of improvement.

[SEE PLATE SHOWING SERIES OF RECORD FORMS.]

In the management of a dental school clinic there is nothing more important than the collection of fees for operations. These fees, as dental schools are now organized, and with the tuition charged, are necessary to the life of the school, and their collection

is managed in as many ways perhaps as there are schools. For the regular maintenance of the clinic there should be one regular system of fees in each department, that should be constant in its application and from which every deviation should be according to a well-understood plan that is constant. There should be absolutely no escape for students who violate these rules.

In my opinion it is best to fix the price of the material used at such a figure as to give an income that is satisfactory, and have no other charges whatever. In this case an order must be written for this material and the cash must accompany it; then no mistake can be made, and no evasion practiced. It is best that those operations which require no material be done free; then if the school sees fit to remit a portion of the fee to its students who become patients, or to needy persons as a charity, let every such case be judged of and done by order issued by some one person having that matter in charge, and by no one else. With us, this is done by a demonstrator designated as "the O. K. man," who writes "free," or a given reduced price, on the face of the order slip, adding his signature. That ends the matter. No reduction whatever can be had in any other way.

I am of the opinion that the arbitrary fixing of prices, so much for this filling and so much for that, without definite rules, should have no place in dental schools. Such a plan will inevitably give rise to the discussion of the matter of the justice of the charge between students and patients, and always to the detriment of the clinic. When the prices are fixed and invariable, such discussion disappears. No one can collect these fees more safely for the school or for the good name of the clinic than the student himself under these fixed rules.

In looking over my experience in the clinic and noting the difficulties in keeping correct records, negligence of duty should take, perhaps, the first place. This pertains to all plans whatever, and the simplification of the plans increases rather than diminishes this difficulty. This is especially true of any attempt to shorten the work by taking near cuts. The difficulties due to the carelessness of students is always with us, and it may be expected to remain as long as we deal with congregations of young men, whether these be composed of dozens or of hundreds. Among these acts of carelessness there is not one that will more persistently entangle the

tracing of our dealings with patients than the transfer of patients from student to student without proper record. This will occur most toward the latter part of the session when many of the students have fulfilled their clinical requirements and have a number of patients on their hands with whom they wish to aid their less fortunate schoolmates. Under these circumstances the transfer is all right if done in proper form and so that it can be properly traced. This may be done in one of two ways: First, the patient may be reassigned as a new patient. Second (and this is much the better way), have the first party return to the examiner with his assignment slip, and finding the one of the same numbers in the examiner's file under that student's name, write upon it *"Transferred to No. oo Sr. class,"* with date; then make out a new set of assignment slips in the regular form, and write upon them *"Transferred from No. oo Sr. class,"* with date. In this case it is not necessary to make any new index card or to make any new entry on the numerical index book, for in any effort to trace the patient the assignment slip tells the whole story.

In the arrangement of any such system of records it should be remembered that in a well-ordered school the vast majority of cases will be regular in their course and will never require tracing. It is the few irregular cases or the few cases in which there are bad results, that require tracing in order to fix the responsibility or to find out what has really been done. Therefore we should keep the account in the fewest words for the many even if we should have to consult several files or books in tracing the few cases in which this proves necessary; still, we must have such a system that we *can* trace any case.

The Point System of Credits.

It has been the habit of dental schools to credit students with the number of fillings, crowns, bridges, plates, etc., made, and to require of them that they make some certain minimum number as the sum of their clinical experience before graduation. This I found to be subject to such great abuse by students in the operative department that some years ago I devised the point system to take its place. Finding this to work well in the operative department, it has gradually been extended to about all of the operations of the practical prosthetic department as well. The difficulty found in

the numerical count of fillings made has been that students disposed to shirk this work will pick out the easy fillings to make and discharge the patient with the more difficult cavities unfilled. In studying our records on this point some years ago, I found that one rascally fellow, who had passed an excellent examination, had slipped through and graduated having never made a gold filling that required more than five grains of gold. He had adroitly dismissed every patient with the larger and more difficult cavities unfilled, successfully evading the vigilance of the demonstrators, and doing his patients an injury besides treating them dishonestly. I found this to have been practiced to a lesser extent by a considerable number of students. A small filling counted just as much on their credit sheet as a large one, and the less honest students were taking advantage of it instead of trying to make their experience as full and complete as the circumstances would permit. I found that it also contributed to the tendency to use amalgam in many cavities that should be filled with gold, and was doing harm in that direction as well.

Of course I set out at once to break up that kind of evasion of duty, and this resulted in the devising of the *point system of credits*. In this the number of cavities filled is not considered in the credits to students for clinical experience. Instead of this the small pit cavity in the occlusal surface of a molar, the easiest cavity to fill, is taken as the basis of the point. All other fillings are compared with this as to the time required and the experience to be gained, and the number of points increased accordingly. In the application of this plan a regular scale of points is made out for the different cavities, allowing to the demonstrators a certain range of variation for large and small in awarding points; and this is printed each year in the student's book of rules. I append this scale of points:

Value of the Point.

1 point —Ordinary pit cavity.
2 to 5 points—Small to very large occlusal cavity.
3 to 5 " Proximate cavities in the incisors and cuspids.
3 to 5 " Buccal, lingual, or labial cavities (not pit cavities), in the gingival third.
5 to 8 " Step cavities in the incisors or cuspids with restoration of an angle.
5 to 8 " Occluso-proximate cavities in bicuspids and molars, with contact properly restored.

10 to 12 points—Occluso-proximate cavities, with lost interproximate space from dropping together of teeth at necks, requiring slow wedging, properly restored.

Mesio-occluso-distal cavities will be reckoned as two cavities and points awarded accordingly.

Occluso-buccal or occluso-lingual fillings will be rated as occluso-proximate fillings when there is a similar amount of these surfaces lost by decay.

These ratings apply to both gold and amalgam fillings, with the understanding that no amalgam fillings will be placed in the incisors or cuspids.

Amalgam fillings must be polished at a subsequent sitting. In case this is not done, only one-half the schedule number of points will be awarded.

In any case in which the *contact is not properly restored* with proximate fillings (gold or amalgam), the number of points allowed must be reduced one-third by the demonstrator.

In cases in which from the extension of decay and the loss of walls much building is required, the number of points will be increased in proportion. Otherwise the schedule represents the maximum number of points.

In those cases in which varying credits for small and large fillings are prescribed, the decision of the demonstrator shall be final.

The *points* made represent the experience of the pupil in filling operations. The grade or excellence of his operations will be marked in the percentage of 100.

During four years' experience with this plan it has proved very satisfactory to the student body and to the management. Some others have already adopted it and have reported to me that it is working well. There is no longer any disposition among students to evade the more difficult and tedious operations in order to fulfill the requirements. Of course, any number of points may be designated as the requirement in clinical experience; we have found that the general average is about four and a half points to the filling. We require 75 points from the juniors, and 150 points in gold fillings and the same in amalgams, of the seniors, as the minimum. Students may do as much more as they like.

In the *prosthetic department* the scale of points is arranged as follows,—or in harmony with it for items not mentioned:

Value of the Point.

Repairing vulcanite plate,	4	Plain Logan crown,	4
Partial plate, from 1 to 4 teeth,	3	Shell crown,	6
Partial plate, from 5 to 8 teeth,	8	Porcelain-faced crown,	10
Full upper or lower vulcanite,	10	Banded Logan crown,	10
Swaged aluminum plate,	20	Baked porcelain crown,	10
Watt's metal plate,	20	Bridges, same percentage per each crown and dummy.	
Cast aluminum plate,	24		
Gold plate,	30		

On this scale we require 50 points of juniors and 100 points of seniors. In making these points the student must make a prescribed variety of pieces, but this is made sufficiently flexible to accommodate the kinds of pieces that will usually be presented in infirmary work. It is not considered necessary that each student make the same number of pieces of any given kind. This scale relates only to practical pieces for patients.

The Record of Operations.

The plan of record of operations upon charts of the teeth so much in vogue in dental offices is not suitable for school work. We have been using a different form of chart made up of squares, with figures for the upper teeth, and letters for the lower teeth as shown in the following form:

RIGHT.	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	LEFT.
	H	G	F	E	D	C	B	A	A	B	C	D	E	F	G	H	

In this the figures run either way from the central or *"median"* line, and represent the upper teeth. In the same way the letters represent the teeth of the lower jaw. In representing fillings or cavities on this chart a curved line within the square to the mesial of a figure or letter represents a mesial filling or cavity; a curved line to the distal, a distal cavity. A circle within the square represents an occlusal cavity. These figures and letters are supposed to represent the occlusal surfaces of the teeth, and therefore a curved line above a figure, or below a letter, represents a buccal or labial cavity; while a similar curved line below a figure or above a letter represents a lingual cavity. These signs represent the five surfaces of the teeth and indicate the position of fillings. There is no effort to represent either the size or form of fillings.

These letters and figures can be used just as well and with the same certainty of correct representation without the chart, and on any common book in writing. In this we use only the letter or figure representing the tooth desired, draw an upright line on the right or left to represent the median line, and place the curved line in position to represent the filling. In this way we may record a filling in a single tooth or in any number of teeth on the ordinary page in writing or in print. If we wish to record mesial fillings in

the upper incisors, we would do it thus, 1)/(1. A similar record for the incisors of the lower jaw thus, A,)/(A. Or if it is a filling in the mesial surface of the upper first molar thus, /(6, for the left side, or thus, 6)/, for the right side. If it is a distal surface it will be thus, /6), or thus, (6/, or two fillings in the bicuspids thus, /4) (5, or we may place cavities in different sides of the mouth in the same line thus, (6)/4)(5, recording a mesial and a distal filling in the upper left first molar, a distal filling in the upper right first bicuspid, and one in the mesial surface of the upper right second bicuspid. We may also mix together in the same line fillings in the upper and lower jaws without error. This plan brings the record of fillings into very short compass on any common page. It proves to be easily learned by students and is in common use in our school. By the use of this plan we carry the record of every filling made to the student's record page of our record book, and also record the amount of gold used in making the filling. This rounds out and makes our record complete. I can go over the student's record page and learn very exactly what he has done, when it was done, and for whom. This plan also works very well indeed for records in private practice; it is the plan I have used for thirty years, and I would not exchange it for any of the diagram plans.

Maintaining a Clinic.

The plans employed by dental schools in maintaining a clinic, or in obtaining patients for students, have given rise to some controversy and a good deal of criticism. The idea seems to have been general that the school must furnish patients for the class, and that the class itself is not concerned in the matter. The claim has been widely made that these patients must be from the poorer classes who cannot pay the practitioner for dental operations. On this view some of the schools have claimed the right to attract this class of patients by advertisements that would be a discredit to any reputable practitioner, and by so doing have called down upon their heads the severest criticism. I believe that all this is wrong. Our dental schools as at present organized are not eleemosynary institutions; while they should certainly do their proportion of charity work, and in a degree seek that work, they must be made to pay their running expenses. The idea that the school must furnish exclusively poor people for its clinic is a wrong to the student; for

this gives him a wrong impression of dental practice. It is a wrong to the school, for if it were literally carried out it would be an injustice to the student body. The plan is wrong because it seems to call for advertisements by the school which are unprofessional, setting an example of wrong-doing before the student body that is in itself demoralizing; for in my observation no school has succeeded in maintaining that kind of clinic without advertising.

I should rather maintain that the student having been recognized as having entered upon the study of dentistry, has by that fact acquired the right to student practice under proper supervision and instruction. Having acquired that right he has the same right to those patients that may choose to put themselves under his care, with a knowledge of the conditions, as the practitioner has. The ability to acquire patients and to handle them successfully is a development that must be acquired by everyone before he can maintain a practice, and every young man should be encouraged to begin this development in student life, and to practice it carefully to the end that he may become proficient as a preparation for after practice. I therefore advise students to bring their associates, who are willing to entrust their operations to them, to the clinic. These people come as patients of the individual student, knowing the conditions under which he is operating. They are examined and assigned to the student for whom they call and in all ways obey the rules of the clinic. Who is there among us who will deny the student this right? None, I hope, for to do so is to do the student an injury. What difference if some of these people are well-to-do financially. Has not the student in the school the right to begin his experience in the management of a practice among his equals in financial and social position,—or the same class that he will naturally seek after leaving school?

Then the student is encouraged to bring his friends to the school. They constitute his best patients; they are the ones in whom he is most interested; they are those for whom he will do his best in operating; they are the persons who will call out the best there is in the student in manner and deportment at the chair; they are the patients who will call out the highest development of the student in all desirable points. While it is right that every student should do his share of practice for the very poor, I do not believe it is right to confine him exclusively to that practice.

I tell my students that we depend on them for the clinic in the school; and whether it is good or bad will depend on the efforts of the student body. That they must at once begin the work of practice-building when they enter the infirmary clinic; studying the proper and professional means for the work and applying them for the gaining of patients for their individual school work. I often tell them that the young man who cannot do this while in school had better quit and go to ploughing corn or splitting rails, for however well he may learn the science of dentistry and the technical processes required, he will never be able to command a practice.

This demands of students that they give some time to social intercourse among the people with whom they live, and this demand is a good one. It is opposed to the idea of gathering in large bodies in boarding-houses and club-rooms and associating with students to the exclusion of the outside world; and this is good for the student. It demands the exercise of the social virtues with all of its resulting benefits. It is not necessarily opposed to student societies, student gatherings and associations, or to reasonable clubbing together for living purposes.

This teaching gives a school clinic of the best quality by the best means; it improves and elevates the tone of the class and lends interest to the whole of the school work.

DISCUSSION.

Dr. Faneuil D. Weisse. Dr. Black's paper only came into my hands to-day. I looked it over, as we have listened to its reading, with a great deal of interest. The careful and characteristic manner in which the subject has been developed has left very little to be said. It remains only for others to present special methods which have been the outcome of their individual experiences.

From my inquiries of the deans of our several institutions and from my personal inspection of dental institutions, the reception department of the New York College of Dentistry is somewhat unique in the examining, classifying, and distributing of patients to the several departments,—operating, prosthetic, and extracting,—and especially so in the receiving of money for work to be done, thereby dispensing with the question of money arising between patients and students or demonstrators.

The reception department is presided over by the examiner of patients and the secretary of the infirmary. It is located on the ground floor. The patient on entering applies to the secretary, who gives him or her an examination slip, for which a payment is made to the secretary of twenty-five cents, which is taken to the examiner. The examiner receiving the same records the patient, numerically, and the name and address in a special blotter for the purpose. Examination of the case follows, and the work to be done and its cost is also recorded in the blotter. The examiner fills out a slip designating the work to be done in the operative, prosthetic, or extracting department, as the case may be, with the price for the same. The patient then returns to the secretary, giving him the slip given to him by the examiner, the secretary makes a copy of the examiner's slip on a department card, he retaining the slip to be filed. The patient pays the secretary the amount called for by the examiner's estimate, the secretary stamps the card "paid" and gives it to the patient, and here closes the financial relation of the patient with the infirmary. The patient then leaves the reception department to take the elevator for the department where the work is to be done.

Our method of obtaining the record of students' work for patients and the registering of the same is also somewhat unique. We use check-books,—like a bank check-book with checks and stubs,—for each department of the infirmary, of red paper for first year men, white for second, and blue for third. At the completion of a given operation by a student the superintendent of the department inspects the same, fills in a check with the date, the operation, and the name of the student, signs the same, tears off the check and gives it to the student as his voucher for the work done; the superintendent then fills in the stub in duplicate of the check issued, adding to it the percentage merit of the work done. At stated times the superintendent tears out the stubs of checks that have been issued, turning them over to the clerk of the infirmary, who enters the work done to the credit of each student in the register of infirmary work. The infirmary register is devised so as to afford space for the continuous record of the work done by each student in the several departments—operating, prosthetic, and extracting—during the entire period of the three years of his college attendance, thus affording ready reference to a given student's entire infirmary work.

A very important outcome of our infirmary experience is the safeguards we have resorted to to protect the institution from trumped-up suits for malpractice. During our career of thirty-five years we have been called upon to defend two suits; the first, in the seventies, was decided against the college; in the second, in 1895, the judge did not allow the case to go to the jury after having heard the case for the plaintiff, on the ground that the plaintiff knew beforehand that the work was to be done by students, that she voluntarily accepted those conditions, and if she was not properly treated she must accept the consequences. Under the advice of our counsel we have hanging on the walls of every infirmary room and printed on all slips and cards that pass into the hands of patients, the notice in reference to the work done for patients, "All work is done by students." With the above decision of the court as a precedent, and the thorough manner in which we inform patients that "All work is done by students" we have felt very secure as to suits being brought against the institution for malpractice.

Dr. Black said that "without the infirmary receipts the college couldn't live." I wish we could say that, because our infirmary has always been an expense.

Dr. G. V. Black. I did not say that without the infirmary receipts the college couldn't live. I said the receipts are necessary.

Dr. Weisse. As to the manner of obtaining patients for the infirmary practice of students, we have never asked students to canvass for patients. Occasionally, only, students ask to be allowed to bring their own patients. I confess I was much surprised at the stress that the writer of the paper laid upon students canvassing for patients and the importance of their doing so for their future professional benefit. I do not know how it would succeed in New York. We have never found it necessary to resort to this way of obtaining patients.

Dr. W. E. Grant. I feel my inability to add anything to this subject further than what has been given here, for two reasons. First, I did not have the pleasure of seeing the paper until the meeting was called to order, and second, because many of the points that I have at my disposal, and which we have been using in our college work, have been obtained from the two gentlemen who have just spoken. I have a number of slips here which I fear the late-

ness of the hour will prevent me from taking up in detail. I would be very glad to have the gentlemen look them over, however. I can only in a general way add my approval to what has been given. My impression is that there is nothing so important to the dental school at the present time as the subject that is now before us. It is important for several reasons. Dr. Black has touched upon one of the important phases, and that is the financial side of the question. He has said to us that it is important to look after this, not from a standpoint of revenue alone, but that it is necessary that the infirmary should bring in a certain amount of revenue in order to keep a well-regulated institution going. It is important from another standpoint; that is, we are dealing with the men who are about to be our finished subjects, and here is where we are to give them the finishing touches. Discrimination has been made upon this floor between the practical and what we call the theoretical. We are giving them the practical side of things in the infirmary work, and that which they expect to put into active practice at an early date, and therefore, from that standpoint, this subject is a very important one. And you can appreciate its importance by carefully watching the class of work turned out from your infirmary and by watching the rapid improvement that those men whom we incline to term the theoretical students make, by careful attention to the practical side of the infirmary work. The importance of having frequent demonstrators' meetings and of the infirmary being conducted along the lines laid out by the professor of operative dentistry was touched upon in the paper today. I want to say that we took up these meetings in our college, some two or three years ago (a point gained from Dr. Black), and it has been very fruitful and very beneficial to the college work. Our faculty meetings are held, outside of the demonstrators' meetings, once a month. I like the idea of general examination, or examination of all patients by a demonstrator appointed for the purpose. A great number of infirmaries, I am aware, are not doing this. They allow the patient to go directly into the infirmary and the student is his own examiner. I think it is very important that all the patients should pass through one examiner's hands, even though the patient be a call patient. Someone has put the question, Where is the necessity for a patient who is a call patient to go through the examiner's hands? The case does not have to be as-

signed, but it is just as important that that patient should pass through the examiner's hands as any other, because other considerations of interest to the patient, the student, and the college must be looked after.

Now, the gold question is one which has puzzled us quite a bit, the question as to the amount of money which should be collected for the material used. We have not been able to use Dr. Weisse's suggestion, neither have we been able to use the idea of Dr. Black. We go on the principle that all of our patients are honest, and allow them to pay for the operation when it is completed. Of course, our method of determining the amount of material used, and all that sort of thing, is very similar to what has already been given.

The question of slips, the number of slips to be used and how to classify them, is another important consideration. On this account we have our prosthetic department divided and we have the different colored cards signifying the different departments, and we have found it necessary to use the four slips in each department; four slips in the operative department, four in the plate department, and four in the crown- and bridge-department, using the white slip for the operative, the orange for the plate work, and the blue for the crown- and bridge-work. The examiner also uses the examiner's slip relative to the department in which the patient belongs. Another question that has come up to us is how long to keep these slips. In a measure Dr. Weisse has answered that question; at least he has given their practice. We usually keep our slips longer than has been indicated by Dr. Weisse, but without a definite fixed period. Of course they accumulate very rapidly, and if they are kept for a term of years it requires a great deal of space in order to store them away. We find that the demonstrators are sometimes careless, and it is well to provide a means of keeping a check upon the demonstrators as well as upon the students, and Dr. Weisse has suggested an idea that I think can be used very nicely in the plate-work department and crown- and bridge-work; I even like the idea in technic courses. It certainly offers a suggestion to me that I had not had up to this time. We use the point system, and also the grade, as outlined by Dr. Black. We tell the student the number of points we give him, but we do not tell him his grade, *i.e.* he does not get the grade at the time. There are two or three

reasons for that. One is that we have found it necessary for several years to require more work of students than our minimum, and the demonstrators at times have had difficulty in getting the students to do more work, so we do not tell him his grade on that account, and we simply tell him he must raise his grade. Of course you will have a number of students who want to do all the work you can possibly give them, but in some respects we have been fortunate enough to have more clinic than we were able to take care of, and therefore we want to urge the students to do more than the requirements. We like the point system very much indeed, especially in the operative department. In the prosthetic department we have not been able to use it as well and with as much success as Dr. Black indicates. I hope that we can use it to better advantage from this on. Instead of making it on a basis of 100, we make it on a basis of 10. At the end of the year the total is made and, of course, multiplied by 10. We do that simply for convenience. A man that would make a grade of ninety would get a grade of nine. I was a little bit uncertain, when Dr. Black first gave his method of recording the required operation, and also recording the operation when completed, as to whether or not the student body would understand it, but he afterward explained that satisfactorily. We haven't adopted that method, but have used the old method of charts.

I wanted to ask the question as to how patients are assigned. I wish a little later Dr. Black would answer that; whether alphabetically, or in the order of matriculation, or how?

Another point was the amount of time given to the infirmary work. This has been a question of some consideration to us, and we have adopted for the last two or three years the method of dividing our time so as to get in the didactic work by 12 o'clock, and then beginning immediately after and giving up the time from 12 to 6 to the practical work, and of course the first-year students at that time are at work in the laboratory. All of the lectures are given in the forenoon.

Dr. W. H. Whitslar. To conduct an operatory requires science and productive art. It is an art of contemplating methods of application of knowledge, and this becomes almost a science of itself. The conductor must be an artisan to cause the technicals of dentistry to be applied to natural teeth in the mouth. It requires

technical skill to do this. We often find students trying to accomplish more than they are able, and here discrimination by teachers is desirable. Often incapable teachers are found who have not the sense of propriety, both as to teaching and as to acquiring the sympathetic co-operation of students. Some teachers are too frigid, repellent in all things, hence fail to be good teachers, no matter how great their knowledge. I believe that in most schools we are derelict in our duty in providing competent instructors, men who have the ability, and who have still more, great experience. Oftentimes we select men of no experience to fill these positions; therein I think we err.

Two years ago I presented a paper upon this subject, and also the year before that,—hence I think that Dr. Weisse is mistaken when he makes the statement that nothing has been presented on this subject heretofore, and I just simply wish to call your attention to one phase of the article read two years ago upon the preparation of students for the operatory. I divided it into eight divisions, as follows:

(1) Appreciation of the value of teeth and operations thereon.

(2) The operator: His health, and care of his clothing and hands.

(3) Deportment, and reception of patients.

(4) Dental chairs: Their mechanism; how to adjust chair to the patient and operator.

(5) Instruments of common use: Engines, clamps, forceps, etc., and their care and mechanism, as well as the care of the operating instruments.

Now, all of the foregoing things have been spoken of heretofore in the didactic lectures, but previous to entering into the operatory these things should be called to the mind of the student.

(6) Examination records. These examinations, I think, should come under the head of a thorough, competent examination, and I would also further suggest that the senior class be divided into sections of two or three students who attend to this examination on alternate days, and that these students be required to make examinations of the mouth and have a chart prepared for them to record what they may observe. They may go into all the various phases of diagnosis of the mouth. I would be glad to refer you to a diagnosis chart that we used two years ago.

(7) Preparation of material for filling teeth.

(8) Classes of operations.

A course of lectures upon this line of work should be compulsory to students.

Upon the discussion of the paper at hand to-night, I have only to thank Dr. Black for the instruction which he has given to us, and we all bow to him as the Socrates of the dental profession to whom we look for great wisdom. However, a man was never so great but that he must have some criticism, and I have one or two little criticisms. I wish to criticize the diagram upon the operative record just exhibited. He stated that sometimes schools are subjected to legal controversies; and this diagram which he has would not support him at all in any legal combat, because the judge and lawyers would be unable to comprehend it. I think the only proper way to do is to have a diagram which shows to any person of ordinary mind the forms of the teeth and where these operations are noted.

The point system is all right; it is a good thing, but it does not go far enough. In small schools, like ours, I think the only way to handle students is not to set a minimum limit upon what they do. When you do that they will reach that limit, and the majority will not pass beyond it. If you say to students, You have to work from the time you enter here until commencement day, then the students have just that one rule to go by, therefore they will do better work. I know that is so, because since we adopted a minimum limit the students do less work than formerly.

Now, as I said before, I have no further discussion upon this paper, but simply to bow to our good Professor Black and thank him for these records which I think have been brought down to a system. A few years ago I tried to evolve a system, and corresponded with all the schools in the country. I received from them their record slips and made charts, which were exhibited at that time, and our chairman of the Executive Committee asked me to bring these charts here for your perusal if you desire to do so at any time. There are a great many good points that may be received from them.

Dr. L. P. Bethel. We have adopted a system of records this year in our school, not perhaps as elaborate as the system that Dr. Black presents, but one we have found entirely satisfactory. There

are two forms of slips here, one for "new patients" and the other for the "daily record." You will notice in the right-hand corner of one of the slips, *new patients;* in the corner of the other, *daily record.* Those words are there simply to guide the students. When the patient presents, the student takes a *new patient slip,* and you will notice there is an appointment card attached to it; that, of course, is filled out and given to the patient. Now the student examines the patient's mouth and marks the operation to be performed on the *student's memorandum blank,* and then the examiner examines that mouth and places the operations he finds on the *clerk's memorandum blank,* and the two have to correspond before they are approved, so if the student has missed any of the cavities the examiner finds them and calls his attention to it. In this wav you train the student to be thorough. He notes on these slips any other operations that may need to be performed by simply drawing out a line and indicating the operation by symbols which are printed on the daily record slip. The student retains the student's memorandum, and the clerk's memorandum slip is handed to the clerk for filing. As fast as an operation is performed the student simply draws out a line on his student's memorandum slip and indicates it by a symbol and inserts the date; when that patient returns, the student, by looking at his slip sees immediately what operations are still to be performed.

On the daily record slip you will notice the words: Instruction —Preparation—Filling. The student first receives instruction and then that is punched. The preparation of the cavity is examined by a demonstrator and passed upon. and then a demonstrator makes out the order slip, which is a little different from Dr. Black's [illustrating on board]. Where the student receives the gold or other filling material he initials for it, thus making a receipt for the clerk. When the operation is completed the amount of material used is marked on the daily record slip, and of course the total should correspond with the amount of material which has been received from the clerk. If there is a difference, the student is called to account for it.

In the credits for preparation of cavities we have "fair," "good," and "excellent" grades. We also grade the final filling by points. The charge for the work done is entered by the demonstrator on a daily operating slip, the date affixed, and all is approved by this

demonstrator; the patient then takes the slip to the clerk and pays for the work.

From this daily operating slip the clerk posts to the clerk's memorandum slip the student's and the patient's names, both being given on the daily record slip. The *clerk's memorandum* is filed under the name of the patient; the *daily record slip* under the name of the student. At the end of each month, or every six weeks, the student's record slips are assorted, and are clipped at the corner so that they are all held together, and the summary of work done noted on the back,—so you have a complete record of what the student has done for that length of time. In the cash book each day is entered the student's name and the kind of operations performed, which gives us a daily record of each student's work. The slips are filed under the card system, filing the slips instead of cards. At the end of the year the slips will all be taken and filed away in a letter file for future reference. Where we are working for students or giving special rates to some person, we mark across the slip *"special."* In the prosthetic department we have a similar diagram adapted to its needs.

Another method adopted may not be out of place here: If the student is going to make a bridge or anything of that kind, where it requires considerable gold plate, solder, etc., we weigh this, together with the teeth and gold solder, etc., and when the bridge is completed, but before receiving the final finish, we reweigh it. In this way we can get approximately the amount of gold used, and we find that the clippings of gold come back in more numerous quantities than they did before.

In this way we keep a very complete record of all the work that the student does.

This system of record-keeping being so simple, there will be no further explanation needed; by looking over the slips you can very readily comprehend it.

Dr. W. C. Barrett. The work which Dr. Black has planned out is, it seems to me, that which is more appropriate for the advanced bacteriologist. It is not elementary work for dental students, for beginners, for those who know nothing of the mysteries of bacteriological science. The reason why certain well-known organisms are employed for study is because they better and more perfectly and more easily illustrate proliferation, or the

formation of the products of bacteria, than do most of those taken from the mouth. How would it benefit a tiro in bacteriology to commence the investigation of unknown bacteria? He must know, he must study, those which are known and which more easily and more clearly demonstrate the principle which it is desired to teach. He is incompetent to carry on the original investigation which demands the knowledge of the expert. It is with that view that Dr. Miller has written; he knew that he was writing for dental students,—for novices. He did not write for the experienced investigator, hence he used simple language, employing as few technical terms as possible; I mean unnecessary terms. We must use the correct nomenclature, but I cannot but conceive that the course which Dr. Black would mark out would befog the student rather than clear his perception to a complete understanding of the basal principles. Let him use such an organism as will best determine and most clearly indicate to him the processes which it is desired for him to study. This is the only criticism which I can make upon that which Dr. Black has so well said. I simply believe that he is recommending to the tiro that which must be the work for the advanced student in bacteriology.

Dr. E. T. Starr. I hope that when Dr. Black gets up to close the discussion he will tell us in what way he makes the marks for the temporary teeth on that diagram.

I think the idea about the point system is a very good one, and likewise the method of not telling the student what his grade is. I think it has been our custom in the past to give the student a voucher for every operation performed, if the operation has been passed with credit. We have had some difficulty in getting students to perform a sufficient number of operations. When they have completed the minimum requirement they want to stop, and on that account we sometimes have many more patients than we can take care of. I think that this method might possibly do away with that difficulty to a great extent.

Dr. H. C. Kenyon. In regard to these blanks. In our school each demonstrator has a punch, each different from the others. Whenever he punches a card for material it is permanently recorded who did it, and where there is a place for a demonstrator to sign his name he simply puts a punch-mark there.

Dr. L. P. Bethel. That is the system we use.

Dr. V. E. Barnes. The question has been brought up that the punch might be duplicated. I hit upon a little scheme which I think will prevent that, and that is, instead of adopting a system of numbers, of making a couple of punches on the card which indicates the grade, the student knowing nothing whatever as to what the grade is.

Dr. A. O. Hunt. I simply wanted to ask Dr. Black to state what system or principle he followed in grading,—not in points but in grading; whether it is a question of guesswork with the demonstrator as to whether a student should have 4, 5, 6, or 10, or whether there is some system about the grading.

Dr. G. W. Dittmar. I am thoroughly acquainted with the point system devised by Dr. Black. We have not followed it entirely, but to quite an extent. There is one thing, however, regarding the point system and credits. For instance, a mesio-occlusal cavity runs from 5 to 8 points. If it is well done, we would probably give the student 8 points and probably give him also a grade of from 85 to 95. If it is poorly done, is it right to cut that down to 5 points and also cut the grade down to 75? If we are going to have a point system we ought to give either the maximum in points and then the grade, or a minimum number of points, and grade as to the quality of the work.

I wish to commend the most excellent paper, and in particular the point system.

Dr. Hart J. Goslee. I only want to take occasion to say that the credit system has been adopted by most all of the departments in the Chicago College of Dental Surgery. While it is not necessary for me to go into the details of it, as the ground has been so thoroughly covered, and because I am scarcely familiar enough with it to give it to you in particular, I want to say that the system embracing a certain *minimum* number of requirements may be made successful for the reason that every student is given to understand that he must satisfy each department as well, and that there is no *maximum* number. Each student thus knows that he must have certain compulsory credits and as many more as the professor demands of him; and if he knows that he must satisfy the head of the department, he is going to do it. The methods that we use are along similar lines to those advocated and presented by Dr. Black.

Dr. J. Q. Byram. I hear some saying that you keep the number of points from the students, and I can see no good reason for doing this. I believe in allowing the student to know just how many points he is getting on each piece of work. And as the doctor said a moment ago, it is not right to grade them differently. If we are to have a point system, each student should be given the same number of points for similar operations. We know that students vary in their manipulative ability, but if a student who cannot do a piece of work as good as Jones, does his best, there is no reason why he should not have the same number of points, if he has put forth his best effort.

The way we overcome students refusing work toward spring is like this: We have our point system divided into gold fillings and plastic fillings (including canal fillings), crown- and bridge-work and plate work, and treatments. Each morning our record is posted so that a student may see just how many points he has. At the end of the year we add these together and strike an average. The average is 90 per cent. Each student is required to make 75 per cent. of the average. If a student is low he must work, and as he works he brings up the average, so that the high men who are always anxious to make 100 per cent. must keep on working in order to keep their grade above the average. As the low men are compelled to bring their grade up to 75 per cent. the high men are anxious to keep on working in order to keep their grade up.

Dr. G. V. Black (closing the discussion). I am very glad of the discussion that has occurred on this subject. I consider it a very important one. I should like very much for the discussion to have fallen more on the general principles underlying this work than upon the particular form of slip used, for I consider that if we understand and appreciate the general principles and the needs underlying them, we will be able to form slips that will cover it. I may forget some of the questions asked and I will request those asking questions to repeat them. One question was in regard to our plan of assigning patients to students. In our school there is so large a proportion of the students who obtain and maintain an infirmary practice of their own that it would not be at all right to assign patients in the order of matriculation, or any other regular order. Therefore, as frequently as may be necessary, a transcript of

the record of points made by the students is given to the examiner, and he assigns patients to those students who may need patients.

There is some disposition to mix up the point system of credits with the grades. The point system of credits has to do only with the student's opportunities for experience. The grading of the excellence of his effort is entirely a different thing, and is graded on the scale of 100. We do not give our students the grades; we always give them the points. And we have made it a rule not to give our senior students their grades in examinations, holding that the students who graduate go out upon an exact equality; they carry out with them no difference in grade whatever. If we find a student's grade is not coming up to the point that will pass him, we will begin punching up that student and he will soon find out that his grade is not high enough. But the examination grade or the grade he has made in the operating room is not given to the senior student at all.

Regarding the system of grades. If a demonstrator is grading a filling, for instance, it is his estimate of what the effort of the student is worth as to excellence. I don't think that we can get anything else out of the grading of a piece of plate work. It is the estimate of the demonstrator, or the person who is grading it, as to what that effort is worth as to excellence. If it is a perfect piece in every respect, it is worth 100; if it is imperfect in some little detail, maybe it is worth 98 or 95. And this is the principle upon which this kind of grading is done. The point system, of course, is not grading at all; it is simply a record of the student's experience, his opportunity.

The question was asked in regard to when I would give 5 or 8 points in a mesio-occlusal filling. That would be determined by the size and difficulty of the operation.

Dr. N. S. Hoff. I would like to ask you if in assigning patients in the infirmary you take into account the student's ability and the relative difficulty of the operation to be performed.

Dr. Black. We do. We manage it through the examiner's knowledge of the student.

Dr. Hoff. Doesn't that conflict with your plan of allowing students to bring patients?

Dr. Black. Sometimes a difficult problem comes up in that relation. Occasionally students bring patients whose operations are

of such a nature that we must give the student assistance. We have to do that in quite a number of cases. We do not often rob a student of a patient, but sometimes we even do that because of the difficulty of the operation, it being far beyond the student's ability.

Dr. HILLYER. Are all your credits given by one?

Dr. BLACK. Our credits are scattered through the whole demonstrating force.

Dr. HILLYER. How do they compare one with another?

Dr. BLACK. Very well, because practically in the first part of the session they are in continual consultation in regard to it.

Dr. SMITH. Dr. Weisse said that they made no effort to have students bring patients, and yet I assume that they have no lack of patients. With a similar plan in Chicago would you lack patients?

Dr. BLACK. I suspect that we might. I have not tried it lately. I know it was the case years ago. There is one thing about this that I will speak of in a moment, if you will allow me, just to bring it again prominently before your minds. It is a lamentable fact that we have almost no opportunity in our dental school work to give our students a knowledge of dentistry as a business. They have a right to learn everything during their student life that is possible of dentistry as a business, as well as of dentistry as the healing art or science. One thing that controls us very largely in the matter of the collection of fees and the manner of maintaining a clinic is our view of this business side. It is true that our students know very little, most of them, as to what they should charge for this or that operation. They go out into the world blind, as it were. I wish somebody would devise a scheme by which we could give our students a knowledge of the practice of dentistry as a business, because this is an important feature of practice, after all. We may talk about professional ethics and all that to our heart's content, but a student depends upon this practice as a business, and he must do so. I wish we could give them more of it. There would be fewer of them running off into unprofessional methods if they could go from our schools with a good knowledge of dentistry as a business.

METALLURGY: HOW TO TEACH IT.

BY JOSEPH D. HODGEN, D.D.S., SAN FRANCISCO.

PREFATORY apologies are in bad taste as a rule, but the title of my paper smacks so much of presumption on my part that I cannot refrain from saying that I was programed and my paper entitled by my friends; and, being "in the hands of my friends," as they say in politics, they, and not I, are responsible.

Teaching metallurgy does not differ largely from teaching other subjects in the dental curriculum. Therefore, like other subjects, the time has passed when teachers agree that this subject can be taught in dental schools by long, tedious, and tiresome lectures, without text-book and without laboratory work. The time is also passed, or should be, when this subject is thought sufficiently taught by any other than one of our own profession. I do not mean to disparage the didactic efforts of those teachers who are without the circle of our calling, but I do wish to emphasize this fact, that it is not metallurgy we desire to teach, but dental metallurgy,—metallurgy applied to dentistry. And it is obvious that no one but a practicing dentist can properly apply this, or any other science or subject in the present dental curriculum.

I have long since recognized that the average dental student takes hold of no subject in the curriculum with the same reluctance he does with the subject of metallurgy and its parent subject, chemistry. It is, then, the first duty of the teacher to dispel this reluctance on the part of the student for the subject. The curricula of our schools are constantly criticized by the lavman, the student, and even the physician often, as attempting too much (not to use harsher expressions), in the apparent attempt to teach more science and deeper science than in the judgment

of our critics is absolutely essential for the practice of dentistry. I do not mean that such criticism is warranted, but I do venture to say that in the mind of the thinking student, or the thinking layman, or the thinking physician, the prescribed course of study in dentistry, like that of any other, cannot be too thoroughly, too scientifically, and too broadly taught. Nevertheless, the average student is constantly questioning, "Why so much metallurgy, why so much chemistry, to practice dentistry?" and this, unsatisfactorily answered in methods of teaching, accounts for much of the reluctance.

To discuss this "why,"—to discuss broad and liberal education. to discuss the education of students in the sciences which go to make up the science of dentistry, that they may be able to deduce therefrom the principles of practice,—would be presumption at this gathering of teachers. These things are apparent to all.

Too many students are permitted to enter our colleges with the mistake that they are to be taught as parrots; that they are to be drilled from the awkward squad into the scientific soldier of practice. And why not? Are not legions of our fellow practitioners practicing in imitation of one another, without asking why?

Since, from their narrow point of view, students see so little chemistry in the practice of dentistry, the relationship appears so obscure, and so little dentistry is taught with chemistry and metallurgy, is it any wonder that they take to the subject most reluctantly?

I therefore repeat: it is the first duty of the teacher to dispel this reluctance. This may be done by making the subject an interesting one, by demonstrating its close relationship to dentistry, and by pointing out how invaluable the knowledge of chemistry and metallurgy is, in the scientific practice of our calling. Then the question arises, How can we best make it interesting and show its value? It is no easy task to interest a class in chemistry or metallurgy, but I have found that it may at least be partially accomplished by going deeper into the subject, and making it admired for its own sake, by making it as practical as possible and filled with everyday wants. No one is more inclined to teach theory and truths for truth's sake than I, but cold theory, naked facts, and incomprehensive laws are not at-

tractive to most students. No doubt much theory is essential, but it must be so skillfully clothed with practical application that it is not only presentable, but positively attractive.

I can best make my ideas clear, perhaps, by detailing my own method of instruction: First, I am an ardent advocate of a good text and recitation; second, I would relegate all so-called "lectures" to old methods, doing no more in that line than elaborating where the text, to avoid voluminousness, is insufficient, and explaining where the text is lacking in perspicuity; third, I depend upon the laboratory for two-thirds of the instruction.

Following this idea, the student is assigned a chapter in the text, which he prepares for recitation and laboratory advantage. The subject studied in the assigned chapter is first wrought out in every possible detail by the student, with the aid of his text and laboratory manual, in the laboratory. A recitation is then held at which the teacher observes where to explain and elaborate. In this method the student has three opportunities of learning the subject, and it can be presented theoretically, practically, and applied from every point of view.

The text I employ devotes its first five chapters, of nearly one hundred pages, in a more or less introductory way, to "the properties of metals," which is a physical view of them; "the combination of metals with non-metallic elements," which is a chemical point of view; and "melting metals," and "alloys," which are strictly metallurgical. These chapters may be gone over more or less rapidly, as the teacher desires.

The Laboratories. Four rooms are allotted to the laboratory instruction of chemistry and metallurgy, plans and photographs of which accompany this paper as part of the exhibit. These rooms comprise what we generally call the chemical laboratory, which is used also for the wet and small metallurgical work; a preparation room, for the use of instructors; the metallurgical laboratory, which may be entered from the chemical laboratory as well as from the hall, where the furnaces, forge, cupel furnace, lockers for unfinished work, rolling-mill, anvils, cases for apparatus, supplies, etc., are to be found. Off of this is a professor's room, which is the executive part of the laboratories, and a repository for books and easily injured apparatus. All rooms connect with a large hall.

We call the time spent in the laboratories weekly, "laboratory periods." These are on Mondays from 1 to 4 o'clock, and the recitation is from 4 to 5. The periods occur, therefore, just before the recitations. The first period is entitled "assignment of lockers." The student pays a breakage fee of five dollars, receives a numbered receipt, and has his choice of locker in accordance, though there is really little or no choice. Thirty-two articles of apparatus, etc., contained in each locker, are then invoiced to him, to see that they are in perfect order, after which he is absolutely responsible for the same, and must *at all times* have at hand each article. If he breaks or ruins one, the instructor gives him a requisition on the office, where the student is charged with or pays the price of the new article, and returns with an order on the laboratory supplies for what is wanted. No smallest article or reagent can be removed from the laboratory without a requisition from dean, professor, or instructor of chemistry and metallurgy; so we are enabled to "keep stock." A list of these "senior requirements," or locker contents, together with a copy of the first and all periods, and a requisition blank, are exhibited.

Six long benches accommodating nine students at a time, and provided with three sets of lockers, one set each for freshman, junior, and senior classes. Each student is supplied with separate gas-cock, and water in reach. A set of thirty-six reagents and twenty-five salts, metals, etc., supplies one-half the bench, a duplicate lot supplying the other half. A list of these reagents accompanies the exhibit.

Laboratory manual. We have a manual in prospect as soon as our experience is sufficiently ripened, but at present we are using "advance sheets," as it were, done on the mimeograph and handed to each student. These, under the name of "senior laboratory procedure," numbered periods, accompany the exhibit.

Note-book. Nothing is more essential in laboratory work than a proper note-book. The study of chemistry and metallurgy demands a thinking application. The note-book serves a manifold purpose. Prominently, its advantages are—(1) The student is able to carry from the laboratory more, and more accurate, knowledge than is possible by mere memory or temporary comprehension; (2) it stimulates a real thinking process of how and why, so important in the study of a science; (3) it supplies an oppor-

tunity for expression of thought, review, study, and correction of errors; (4) it enables the instructor to determine what experiments are best suited for teaching certain theories and truths; to comprehend the individual work of each member of the class; to take the roll, etc.

Our note-book (a new and a used copy is presented with the exhibit) is sold to the student at the small cost of ten cents a copy. The notes are made in manifold by the use of a carbon sheet; the original is torn off at the perforation and dropped into the desk, as into a letter-box, for the instructor, as the student passes from the laboratory. The carbon copy is retained in the note-book for the use of the student. The instructor looks over the notes, corrects errors, takes the attendance therefrom, and learns the best method of teaching and the progress of the students. The cover of the note-book gives all the necessary laboratory rules and suggestions, and a list of abbreviations.

The course of instruction. To more than outline this would be tedious to those not interested in the instruction of this subject. I will therefore content myself with again referring those interested to several copies of the text, copies of the "senior laboratory procedure," or "periods," the note-book, etc., which are among the exhibits, trusting they will avail themselves of the opportunity of looking them over, and offer in discussion whatever suggestions may occur to them in the perusal of the same.

I would, however, explain that the course comprises twenty-eight weeks, of three hours laboratory instruction and one hour recitation, per week. Further, that the first individual metal considered is *"Lead,"* Chapter VI, and with it the sixth laboratory period. This is discussed first for the reason that its metallurgy is simplest. The student is here taught the simplest character of reduction, tests, etc., the preparation of the simplest alloys (lead and tin), and the casting of the easiest ingots. Hence this metal seems a logical beginning of the study of metals. *"Antimony"* follows,—without a laboratory period, from the fact that it is little used outside of alloying, and this is practically considered under other alloys. Two recitations and two laboratory periods are given on *"Tin,"* on account of its prominence, the practical work it affords, and the ease with which it is handled.

In *"Copper,"* most difficult alloys of brass are made. Some

of these are swaged into metallic bases for specimen work in prosthetic dentistry. An electro-deposited base of copper is also made, the student making the cell or battery in a glass tumbler with copper and zinc as elements and copper sulfate solution as the excitant, preparing the cast and using a crystallization dish containing copper sulfate solution as a bath. The base may afterward be tinned and vulcanized upon for specimen work.

Under *"Zinc,"* the basic zinc cements are prepared from the metal, shaded with slate, etc.; this forms a good practical lesson.

In *"Silver,"* two laboratory periods and two recitations are held. Refining the metal, preparation of pure silver nitrate, alloys for various purposes, and solders are made, obviously more for their technical than practical value.

In the consideration of *"Gold,"* five laboratory periods and four recitations are held. The student is required to bring to the laboratory gold scraps, filings, old jewelry, or any alloys containing at least two and a half pennyweights of pure gold. This is first melted in a button and tried on the anvil for its malleability. If malleable, some bismuth, lead, antimony, or what not is added by the instructor, record being kept of the addition by him and by the student, and the whole is then roasted until malleable again,—teaching the method of rendering brittle gold malleable. The student is taught that this process does not necessarily raise the karat of the gold employed, or, in other words, is not a refining process.

To refine the button it is alloyed at the next period with three times its weight of silver, and the "quartation" process gone through with. This, as a rule, with a careful student, gives gold of about 997 or 998 fineness. Taken in the form left by quartation refining, it is placed in aqua regia for greater refining. From this we usually obtain from each student a gold of sufficient fineness to roll to No. 30 or beat to No. 4 foil, some of which is exhibited. A portion of this is used practically to fill either a tooth in the mouth at the infirmary or an extracted one (see exhibit). One of the greatest truths taught is that pure gold exhibits the property of welding when cold, and the greater its purity the greater its weldability. The student is too apt to think the various preparations of commercial foil, pellets, etc., are treated in some way to make them weldable. He is con-

fused by the terms "hard," "soft," "cohesive," "non-cohesive," "semi-cohesive," etc. This work teaches two kinds of foil, *pure* and *impure,* respectively weldable and non-weldable. Gold base-plate and solders are made, partially supplying the wants of the infirmary, while at the same time teaching the student.

The last two chapters of the text are devoted to the consideration of *"Amalgams,"* and furnish four recitations and four laboratory periods. Our laboratory work on this subject, I feel, is yet undeveloped, on account of the want of expensive equipment. Each student prepares and studies several different dental amalgam alloys, and analyzes old amalgam plugs. But I am confidently hoping to perfect the course by the use of Dr. G. V. Black's instruments and methods at no late date; then our opportunities will be unsurpassed. For a long time all the dental-amalgam alloys used in the infirmary have been made by the students, or under the direction of the laboratory instructors.

Each student pays a deposit of five dollars on taking his locker in the chemical or metallurgical laboratory. He replaces each article with which he is furnished, at the time it is broken or destroyed, at his own expense, and is returned four dollars at the end of the session, the remaining dollar of the five going to replace the laboratories in proper condition for the next class. In this way, by careful, systematic, and economic management, the laboratories are just about self-sustaining.

I trust you will pardon the length and uninteresting character of the paper, and also my constant reference to the subject of chemistry. I regard metallurgy as but a part of the greater subject, chemistry, and so inseparable that the former cannot be considered without dealing more or less with the teaching of the latter. My time, taste, study, inclination, and devotion has been and is almost exclusively chemical, therefore the study of pure chemistry and dental chemistry has been my hobby, and metallurgy is more or less incidental.

Thanking you again for your patient attention and consideration of my exhibit, I will close.

DISCUSSION.

Dr. J. P. Buckley. It is with a feeling of sadness on the one hand, and regret on the other, that I find myself called upon to

open this discussion. After I had been called upon by your committee and had decided to attend this meeting, one of the things that I looked forward to as giving me a great deal of pleasure was that I expected to meet here the gentleman who, according to the program, was to immediately precede me in the discussion of this paper. I never had the honor of meeting Dr. C. J. Essig in person, but I feel that I have met him oftentimes in the noble, inspiring, and lasting thoughts that he has left to the profession which he followed. So I regret that his absence through death necessitates my being the first speaker on this occasion.

I open this discussion, on the other hand, with a feeling of regret that Dr. Hodgen,—a man, too, whom I never met,—could send a paper to Nashville and one to Minneapolis, but could not send one to Chicago. So I regret that I haven't had the opportunity of seeing this paper until through the kindness of Dr. Owre it was placed in my hands last night that I might look it over and gain the salient points; but in my effort to remember all of the good things that were said here yesterday, and the fact, too, that every time I would get started on a good point a locomotive of some sort would come up the main street of this city, confused me so much that I found it difficult indeed to confine my mind to even the reading of this enticing paper. But I have listened very attentively, as have each of you, to the reading. Dr. Stubblefield has read the paper with such a distinct voice that I now feel somewhat familiar with its contents.

The thing that impresses me most in connection with this subject is the practical manner in which the essayist has presented it for our consideration. He has certainly shown us that the subjects of metallurgy and chemistry are interesting ones. I have been familiar with the fact for some time that dentists as a rule fail to take an interest in anything which relates to chemistry or metallurgy. Metallurgy being based upon chemistry, they feel that it is impracticable, that it is uninteresting. I am glad to know that the dental teachers, at least, of this country are interested in this subject. I was pleased yesterday in the address of our worthy president where he referred to teaching chemistry in the first three years of the dental course. I was pleased when I noticed that he emphasized the necessity of teaching this science, which underlies the study of metallurgy, in the first three of the coming four-year

course, but I was surprised at the statement of a gentleman who followed, who is, I am informed, the dean of a dental institution, who feels that chemistry is so uninteresting and unimportant that a sufficient amount of it could be taught in two years. The man who makes that statement forgets the fact that dentistry is based upon four fundamental sciences, one of which is chemistry. The man who makes that statement, gentlemen, is unfamiliar with the fact that chemistry, the underlying science of metallurgy, is commingled with almost every study taught in our dental institutions. So I regret that I heard that statement made by, as I am told, the dean of a dental school.

The essayist has given us in detail a discussion of the outline, or I suppose I had better say method, which he pursues in teaching metallurgy to dental students, or, as he has chosen to call it, in teaching dental metallurgy. Now, there is one element which logically precedes method in the presentation of any subject to any class. The essayist had this element prominently in mind, although he failed to call our attention especially to it. But that thing upon which method depends for its life and its vitality is the aim of the teacher, the results which the teacher expects to accomplish, or, if you wish to call it so, the teacher's ideal. Tompkins, in his "Philosophy of Teaching," defines method as being the way, the process, the movement by which ideals set up are realized. The teacher forms an ideal; he sees the results to be accomplished; and then the way of accomplishing those results, or the process of impressing his ideal upon the minds of the students, naturally claims his attention. The essayist makes the statement in his paper that it is difficult for the teacher in metallurgy and chemistry to succeed in arousing the interest of the students. That I believe to be the only statement I noticed throughout the entire paper to which I must take exception. Whether or not metallurgy is interesting or uninteresting to the dental student depends, it seems to me, wholly upon the ability of the teacher to present the subject. And the teacher's ability to teach this subject successfully, that it may be interesting to the students, depends upon two special qualifications. The teacher, of course, must have all the requirements that go to make a teacher in general, but besides this, the successful teacher in metallurgy must have these two special qualifications, and the essayist mentions those qualifications, and

yet he says that that specially qualified teacher fails to interest a student. The first qualification to which I wish to call your attention is a knowledge of chemistry. Second, equally as important as the first, is a knowledge of the practice of dentistry. Now it is a fact that dentists as a rule are not sufficiently versed in the science of chemistry to enable them to teach it, so the deans of our dental institutions are compelled, whether they wish to or not, to go outside of our profession, to go to the medical profession and to the universities, and there select the man to hold the chair of chemistry in our dental schools. And a glance through the catalogues of these schools shows that with few exceptions the chair of chemistry, not a dentist, teaches metallurgy. Now, gentlemen, with this fact prominently in our minds, we can see why it is that the dental student enters upon the study of chemistry, and especially metallurgy, with the degree of reluctance to which the essayist has referred. I reiterate, then, that whether or not this subject of metallurgy is interesting to the dental student depends solely upon the teacher's ability to present the subject, and this depends upon these two special qualifications.

There can be no division of opinion on that part of the paper where the essayist refers to teaching metallurgy in the laboratory. He says, I believe, that he spends two-thirds of his time in the laboratory. There can be no mistake in this. If we wish to achieve the highest result possible to be achieved in teaching chemistry, we must teach it first in the lecture-room, where the student gleans a faint idea of the facts presented, and then that lecture must be supplemented by a thorough laboratory course where the idea that was faintly gleaned is thoroughly impressed upon the mind of the student. And what is true of chemistry in this regard is equally true of metallurgy. Metallurgy must be taught in the lecture-room and the lecture supplemented by a thorough laboratory course. But as the teacher, in order to successfully teach metallurgy, must have a knowledge of chemistry, so too must the student, before he can arrive at the point where he can comprehend metallurgy as we would like to teach it or as it should be taught, be first grounded in the principles of chemistry. And we find in the institutions where we have but two years of seven months each,—I believe in California they have nine months,—in which to take up and complete both the subjects of chemistry and metal-

lurgy, that by the time we have these students who know nothing, or practically nothing of chemistry,—and I say this with all due regard for the high schools,—that by the time we take them and familiarize them with the science as we must do, and get their minds developed so that they can comprehend and understand metallurgy, our time is very nearly exhausted; so we have been handicapped for time in the teaching of this subject, metallurgy. It would simply be impossible for us to take the class of students that come to us to-day without any university training and first familiarize them with chemistry as we must do, and then follow out this extensive outline given us by the essayist, all of which I concede to be thoroughly interesting and practical if we had the time to teach it. But we are rejoicing over the fact that in the near future another year is to be added to our course, and we hope that the majority of the deans will not underestimate the value of this study and that more time will be assigned to those who are teaching chemistry and metallurgy. And we hope then to be able to go into chemistry and teach it as it must be taught and have sufficient time to carry out as extensive an outline on metallurgy as was given in this essay.

I would like to say something about teaching metallurgy in the laboratory, but I have already taken up so much time that I will do this but briefly and hurriedly. This is the place where I feel especially at home. The one who directs a laboratory must be the individual who has given the lectures, or else someone who is intimately acquainted with those lectures. There must be an harmonious relation between the director, if he be not the one who is giving the lectures, and the lecturer himself, that the faint idea of the facts presented in the lecture-room may be thoroughly impressed in the laboratory. In the lecture-room the lecturer presents the facts to the student, and those facts are brought home to him in the laboratory. And then, too, the successful director or teacher of metallurgy in the laboratory must not be a man who is contented to sit upon an upholstered seat in some prominent part of the room. He must be willing to get right down among the students and see that each and all are taking an active interest in the work, see that they are following out his directions not in a parrot-like way, but that they know why they are doing that which they have been asked to do.

I must, before taking my seat, congratulate the essayist upon the practical manner in which he has presented this subject for our consideration.

Dr. ALFRED OWRE. After a careful perusal of this interesting and instructive paper and exhibit, I find very little to add or criticize. Perhaps a few reiterations, modifications, or suggestions will be of some value.

The first statement: "Teaching metallurgy does not differ largely from teaching other subjects in the dental curriculum." Very true; however, it should always be borne in mind that this subject presents the same difficult problem to solve as do other fundamental sciences which must only be partially drawn upon in order to lay a solid and thorough foundation for a subsequent successful modern dentist. *E.g.,* How much of the general science is it necessary to teach to gain a clear understanding of it, and how much further than that should the work be carried? As a method of teaching the essayist suggests generally short lectures, recitations, and laboratory work. This has gradually been adopted by a majority of colleges and is used in nearly all lines of teaching, as it gives best results and only needs constant reiteration.

Again: This subject should be taught by one of our own profession, especially since it is *metallurgy* applied to dentistry that we wish to teach; and further, he says it is obvious that no one but a practicing dentist can properly apply this, or any other science or subject in the present dental curriculum. In a certain sense this is so, but it is also a Utopia in dental teaching which I think is too far distant in realization, for the following reasons: Professional men, however successful as practitioners, are seldom efficient teachers. Few of them have ever studied how to teach, and still fewer ever acquire this *paramount* accomplishment. The science of teaching forms a part of the curriculum of colleges of science, literature, and arts. Metallurgy is wholly dependent upon the mother science, chemistry. How many dentists are good enough chemists, how many have specialized in chemistry or metallurgy? Furthermore, if we had an overflow of such men, how much time could they devote to the practice of dentistry proper? Now, this is a general synopsis of the situation, and I am happy to note some exceptions. So I should rather compromise when necessary and I observe that a number of schools employ men with only baccalaureate degrees to

teach chemistry, or chemistry and metallurgy, and then have the special dental application taught by dentists.

The essayist speaks of the reluctance shown by students in taking hold of this subject, and the necessity for dispelling such reluctance at first. As a cause I think he refers to public criticism on the fullness of our course, etc. Whosoever these public critics may be, they should be ignored generally, for no one can inaugurate a dental curriculum better than men of our own calling. However, they may be allowed to give a just criticism on the curtailing of practical dentistry in some places. Otherwise the essayist has the remedy well in hand, and it is outlined to perfection in the paper. For instance: In order to make this subject an interesting one a partial remedy is suggested by going into it deeply enough to make it admired for its own sake; next, the practical deductions should predominate. Theory is essential, but must be so skillfully clothed with practical application that it is not only presentable, but positively attractive. Right here the essayist has struck the keynote to the whole situation, and from my own experience I heartily indorse such methods. Personally I try to dispel this reluctance at the very first by preceding the regular course with one or two lectures on the history of metals, metallurgy, and metal work, illustrating as far as possible with specimens from various countries, referring to masterpieces of metallic art, such as students are apt to know more or less about.

As to the course itself, the essayist ought to be congratulated for being able in a measure to carry out his ideal. Generally speaking, metallurgy receives enough attention, as it is outlined at present in the University of California. There is some repetition in the laboratory work, and this is only referred to because if left out it would give more time for practical work. Again, some of the work done in the metallurgical laboratory is in other schools called chemical,—another example of the intimate union of the two subjects. The order in which the work is taken up might be modified some; for example, the alloys should not be considered until a few of the most important metals have been dealt with in full. The student, having thus found out the shortcomings of the properties of the individual metals, a reason for alloying becomes apparent. I take up iron first (*e.g.* after preliminaries as outlined by the essayist), because it is typical in its metallurgy; students are

somewhat familiar with its properties, such as its industrial and commercial greatness, its uses for dental appliances, instruments, etc., which all tend to make it interesting. Then gold, silver, copper, tin, mercury, alloys, and dental amalgam alloys, finishing with the rest enumerated, and a few more, such as cobalt, nickel, manganese, magnesium, etc.

Dr. J. H. Kennerly. I am not a metallurgist, consequently I do not care particularly to discuss the paper from a metallurgical standpoint, but to set straight the gentleman who opened the discussion on this paper. He refers to the outline of the course in the first, second, and third years as outlined in the address of the president. In my reference to the paper I stated that sufficient chemistry could be taught in two years. The gentleman failed to grasp the point that I wanted to make, and it was simply this: If you will notice, in the discussion of the president's address there was absolutely nothing said about practical work; adding more theoretical work in the first and second years, carrying the fundamental principles on to the third year, and practically leaving only one year for dentistry proper. My idea in putting chemistry in the first and second years was simply that we should teach more of it in the first and second years, and complete it in the latter. If you teach eight hours a week, as we do, instead of three or four, I think you will grant that we can accomplish as much in two years as ordinarily would be accomplished in three. That is the point that I wanted to make, and I repeat that by so doing you would get more than the president of this association demands. He demands an equivalent of the medical chemical education. Eight hours a week for two years will give you more than any medical school in the United States teaches.

Dr. Buckley. I see the point that the gentleman makes, and it is well taken. Of course, as I indicated in my discussion, I understood that he intended to underestimate or minimize the value of chemistry.

Dr. N. S. Hoff. I cannot discuss this paper, but I want to ask a question. In many schools there is no opportunity for doing laboratory work in dental metallurgy, as the facilities required for it in the way of laboratory room and apparatus are not to be had. Would it not be possible, where such conditions obtain, to teach it in a demonstration course, in which all the processes might be carried

out before the class without requiring the students to actually do the work? Would not such a course be of some value? I would like to have the opinion of some teacher on this point, if he is willing to give it.

Dr. ALFRED OWRE. That point is very well taken, and I will outline the course in the University of Minnesota. There the chemistry is in charge of the master of arts who has studied chemistry in Germany. After the students have completed their laboratory work, such as the quantitative and qualitative analysis, then there is a course in alloys given in Dr. Hodgen's metallurgical laboratory. I think they perform something like four or five experiments, and that finishes the chemical work in the laboratory. The quantitative analysis is not carried out very largely by the students, owing to the fact that we have not a sufficient number of balances, instruments, and appliances. We get something like seven or eight every year. These are imported from Germany at great expense, and they wear out very soon, so that we are handicapped there. The lecturer makes a great many of those experiments himself in the course in the lectures.

Then in the dental application: I have charge of that myself and give something like thirty-six lectures and five half-day demonstrations. There I take up the purification of such scraps as the dentist has, silver, gold, and platinum, and I conduct that from beginning to end before the class. It is not obligatory for the students to do any of this work, but I usually call down four or five students and let them assist me. I have a very small demonstration room, and have the class all around me so that they learn, I think, as much as if they did the work themselves. Then I make the alloys in the same manner. After I obtain the pure silver or gold I make the plate material of various karats and various composition, such as is used in the crown and bridge department and the plate department, and I let one of the students take it down and roll it out and deposit it with the clerk to be used. So he has followed the process from beginning to end, from purifying the scraps until he has the alloyed plate, although he has not done much of it himself. Now, if students have some scraps and want to go through this process themselves, I give them the key to my laboratory and let them perform the operation and tell them to call on me for personal demonstration. We have an

obligatory requirement, which is the manufacture of dental alloys; that they must perform themselves. I take from six to eight students at a time and demonstrate this from beginning to end, —selection of material, weighing, etc., and tell them the reasons for performing these operations in such and such a manner, and I invite the class at all times to ask me questions. If you haven't tried this method, I think you will find that it is very exhaustive. It is more difficult for a teacher to answer questions than to ask them. After melting this alloy they have to file it and strain it, pass the magnet through, etc., aging according to Dr. Black. The student makes ten ounces and pays for the material, hence it is his own. Very few of our graduates buy dental amalgam alloys after finishing this course.

Dr. W. E. Grant. I just want to emphasize one point brought out in the paper,—the suggestion of Dr. Hodgen as to the use of a tablet and requiring the students to write out the work of the afternoon in the laboratory, tearing off one sheet and depositing that in the laboratory and the student keeping the carbon copy for reference. We have used that for two years. I might say that Dr. Hodgen is a Kentuckian and was reared near Louisville and we have had the pleasure of a visit from him. We have used that method and the professor of chemistry and metallurgy likes it very much. It enables him, as Dr. Hodgen has indicated, to get at the attendance, and it compels the students, in a large measure, to go through the work themselves, and it certainly does not permit of any copying outside of the laboratory. The professor of the laboratory has two assistants with him every afternoon, and of course, being assisted in that manner, they can prevent copying, to a great extent, in the laboratory.

There was a point brought out in the paper that I don't agree with,—that is the fact that the work is strung out for a long time. The essayist recommends twenty-eight weeks, four hours a week, three in the laboratory and one in the classroom. I think it is a great mistake to string out any subject over a long period of time. I believe better results are obtained by devoting a great number of hours in as short a number of weeks as possible. Your students are confused if work is too much divided.

Dr. S. H. Guilford. I think that in the teaching of this subject very much depends upon the individuality of the teacher and his

ability. I was very much pleased with the remarks made by Dr. Bethel, particularly when he said that he believed the successful teacher of metallurgy must necessarily be one who understands the practice of dentistry. The reason why we have so few good teachers of chemistry and metallurgy in the dental profession is that busy dentists do not feel able to give the time to it. Medical men are selected to teach chemistry and metallurgy because they devote comparatively few hours a day to their practice, and the rest of the time they can give to college work, whereas a dentist who does anything of that kind sacrifices more than he feels able to. It is deplorable that we have to depend on the medical profession as much as we do. I believe every school would be better for having a practical dentist filling every chair, because a dentist knows better than anyone else what a dentist needs. This brings out a point in reference to Dr. Essig. Dr. Essig was a practitioner of dentistry and had a very full practice, but early in his career he felt the desire for a more thorough knowledge of chemistry. He placed himself in the hands of one of the best professors of chemistry in Philadelphia, fitted up a little laboratory in his own office, and devoted all of his Sundays to it, until he acquired a very thorough knowledge of the science. It was that knowledge which led to his selection as professor in one of the dental colleges. After he left the first institution and entered another, it did not fall to his lot to teach chemistry, but metallurgy, and he was able to teach it all the better on account of his knowledge of chemistry. So that he should have been, and I presume he was, an ideal teacher of metallurgy. I mention these facts because many here do not know them. If we had a greater number of this class of men, these subjects would be made more interesting and they would be properly taught to the students.

Dr. D. R. Stubblefield. I have the authority in my hand to discharge a duty that I find is unnecessary. Dr. Hodgen wrote me to follow up the discussion on his paper and to reply to criticisms made. To this end, I wish to discharge him of one imputation (very slight, to be sure) that Dr. Buckley made. He presumes that Dr. Hodgen sent a copy of his paper to me at Nashville, but that is not so. He sent it on here with his exhibit, and I didn't read its conclusion until I read it before you.

I wish to add my corroboration to the remarks that have been

made along the line that has just been pursued by Dr. Guilford. I have had the duty of discussing metallurgy for quite a number of years in our school, and I was obliged to teach chemistry with metallurgy. The point that I have always realized and tried to make very clear was that metallurgy was in no sense not chemistry; that there was no line of demarkation that could be drawn between them. In teaching chemistry because I was a dentist, and because I saw just these practical necessities that have already been presented, I was carefully preparing the way for the time when I could turn and say, Now we have entered a field that has a practical trend, a practical value easily seen. This is chemistry which is known as metallurgy, because a metal or a metallic element is none the less a chemical element because it possesses the peculiar properties of a metal. And in this way I hypnotized them, as it were, and they found themselves discussing metallurgical subjects, of a practical nature, that were more and more strongly presented as we advanced.

One more word, with reference to the necessity of having practical dentists as teachers. I have for years realized and believed that the very best teacher was the man who was a practical dentist, fully prepared and equipped to teach the subject desired. I feel we made a mistake because we could not have every man in our faculty a practical dentist; not that these medical men may not teach in a general way, and even broadly, the subjects desired, but I have a conviction that a practical dentist knows something of the application of those branches to our needs that the man who looks at it from the outside can never know, I don't care how well informed he may be. I believe there is a practical suggestiveness about the knowledge of a man engaged in the practice of dentistry, which enables him to fit the branch more thoroughly to the needs of dental students.

In conclusion, I shall write to Dr. Hodgen and tell him that the criticisms were all favorable, and with some few exceptions I must add my unqualified indorsement. I do not believe that he has dragged it out too long, and I do not believe that we can get too many practical, and therefore desirable, results even by as long a course as he presents.

THE TEACHING OF PROSTHETIC DENTISTRY.

By GEO. H. WILSON, D.D.S., Cleveland, Ohio.

From the make-up of our program it is very evident that the thought uppermost in the minds of the Executive Committee was, "How to Teach." A more central thought or a more inviting subject would have been difficult to find. Should we have many positive though opposite views expressed, and each writer and speaker should assert that his method is the nearest to perfection, he would be excusable, because it is to be hoped that every man who has been teaching from five to fifty years has developed and is pursuing with all his might his highest ideal. It will be deplorable if there should be one of us so self-sufficient that there will not be at least one point so strongly presented to the mind that through it his work will be better for the remainder of the year. The same idea may be presented several times, but that will only demonstrate its utility and confirm the users in its value.

In my own mind I am satisfied that the teaching of prosthesis is the most important subject in the dental college curriculum. There are several reasons for this. I believe that it is universally a study of the first year, and, being the one so-called practical study, it is the most attractive and appeals the strongest to the student's heart. For this reason the teacher of this department has a great responsibility resting upon him. It is within his power to mold the plastic clay of the human minds about him so as to develop broad-minded, liberally educated professional gentlemen, or it is possible for his influence to be toward the other extreme, a mere mechanic, and such as a young man in a dental parlor de-

scribed when he said, "A man cannot be an honest man and practice dentistry." The ideal teacher of this department will inspire the student with the necessity for the correlated branches of anatomy and chemistry; the importance of these branches being established, the others assume their natural relationship. It is this teacher who has it in his power to first establish by example the meaning of "a professional gentleman"; and this department first demonstrates the necessity of manipulative excellence. Many of the students entering the schools have the minimum preliminary educational requirements, and many of these have spent several years in pursuits that have not tended to keep at par the training with which they are accredited. Therefore it is possible for the unsympathetic, unprepared person, trying to teach this department, to spoil many a diamond in the rough.

The questions naturally arise, What are the methods necessary to make the most of this department, and how are they best used? We make the assertion that all methods have virtues, and the best results are obtained by the best combination of the various methods. The difficult problem to solve is, What is the proper ratio of one method to another?

There is one factor in successful teaching that must not be lost sight of, because it is the essential element of all meritorious work,—that is, the teacher's individuality; but that is entirely outside of the pale of our subject, and can logically only be mentioned, not considered.

We will classify the methods of teaching prosthesis as follows:

- (1) *Didactic*
  - Lecture.
  - Classroom
    - Quiz.
    - Recitation.
- (2) *Technic*
  - Class as a whole.
  - " in sections.
- (3) *Practical.*

Didactic. This general method we place first because we believe that it is the most important of all the methods in producing professional men; the technic and practical methods develop the artisan. Without this essential phase of dentistry our calling would

be a failure; with the higher intellectual and moral training it is lifted out of the common, to the more exalted position of a profession,—thanks to the noble character of the leaders and teachers of dentistry forty and fifty years ago!

The didactic system contemplates two distinct methods,—the lecture, in which the teacher does the talking, and the classroom, in which the student does the principal part of the talking.

The lecture we place as the most important of the didactic methods for producing professional men. The lecture-stand is naturally occupied by the older men of the school. "Old men for wisdom, young men for action." The lecture-room demands the most active mental exercise, hence is the better fitted to develop mentality and individuality, the essential features of professionalism. The lecture is the place to teach economically the reason for and the philosophy of the methods taught in technics and practice. It is the place to teach students to receive mental impressions and to make practical use of them. It is very exasperating for a man of mind to hear a man of body say, when a principle has been thoroughly exemplified, that he does not understand it, but if he can see it done once he can do it himself. What mechanic cannot? It is this lack of mental development that keeps many men from dental societies.

I know that there is a great cry going up all over the land for practical methods,—practical, how to do something,—as though the ability to get the dollar and get it quick is all there is in this life. We of a more esthetic and broader mind must not be carried off our feet by this paroxysmal babble; we must think of the honor and glory of the profession we are to hand down to our children and successors.

Classroom Methods. The two subdivisions of this subject contemplate two distinct principles and are used for different purposes. The first, the quiz, is designed to supplement the lecture work, to see that the students have comprehended the matter previously taught, to aid them in grasping the thought and expressing it in their own words. It should aid the student to think for himself, and cultivate a taste for reading upon the subject in hand. The best results should be obtained by the lecturer quizzing upon his own subject. The recitation plan has for its centrai thought the idea of studying a book and putting into words a

thought the student may never have heard expressed. The student must depend largely upon his own judgment what to commit and what to read over. He will be most fortunate if he does not find that he has memorized the non-essentials and ignored the essentials.

It seems to me that the teacher should be a mentor, a friend to advise and point out the way, and not a taskmaster to see that a stunt has been done. This is the idea rationally implied by the two methods, but of course always modified by the teacher's individuality. It always impresses me that the recitation applied to mature minds was an acknowledgment of inability and unfitness upon the part of the teacher. The argument is often made that the recitation gives the student something to do, therefore he is interested. It is obvious that the lecture and classroom work is by word of mouth; someone must talk, and only one at a time. If the student can tell the story more concisely and impressively he certainly should tell it, but it is evident that the teacher is not the man for the place. The truth is, only a very few students give a good recitation. At least one-half of the students will waste most of their allotted time, and that means at a very conservative estimate a loss of twenty-five per cent. of the hour assigned. The recitation plan *per se* I am radically opposed to, while I am as strongly in favor of the quiz.

Technic Methods. It needs no argument with this association to confirm the importance of technics, but we are not a unit as to what, how, and how much should be taught in this course. To answer the question, What should be taught in technics? I would say, Every operation and mechanical process should be performed technically. How? is a long subject by itself, and we simply pass it over. How much? we will answer by considering time; that is, as much time should be used to cover all kinds of technic work as is used for practical work. The ratio between each technic course and the corresponding practical work would not be the same, but the totals would be.

I have made two subdivisions of technic teaching: "Class as a whole," and "Class in sections." The prevailing system has been to teach the class as a whole, no matter how many it may contain. This has proved a difficult problem, because some are so much more expeditious and successful in whatever they undertake

that it works a hardship to keep a pace commensurate with the slowly plodding ones. I believe that the time will come when the large classes will be for certain purposes divided into sections of six, eight, or ten.

Practical Work. Perfection in this department is in one sense the aim sought by the other methods, and can justly be considered the last step in making the finished operator. We do not desire to graduate a man with educated, refined instincts, and poor manipulative ability; nor do we wish to place the seal of commendation upon the man who is a finished mechanician and is intellectually and morally below par. Of the two I believe that the patient had better intrust himself to the care of the gentleman.

Thus far all we have said is general, and is as applicable to one department as another. In my practical application of these ideas I divide the subject into plate-work and crown- and bridge-work. I teach them in the order named, arranging so that the didactic instruction in plate-work will be completed the first year, and crown- and bridge-work the second year. The technic work is nearly the same. The crown technic is finished the first year, beginning the bridge-work the second year. All technic work is to be finished about the middle of the second year, when the entire time from 9.30 in the morning until noon is devoted to practical work, in plate, crown and bridge, and orthodontia, for the remaining year and a half.

In technics, verbal instruction is confined to very short talks telling the class what to do and how to do it. This instruction is also written upon the blackboard in as concise terms as possible. The desire is so far as possible to have the student become familiar with the technic of a given subject before it is considered in the lecture-room. By this means the student knows what we are talking about and the lecture is of vital interest, because it explains why he did so and so, also why he met with certain difficulties and how he can overcome them. The student having some knowledge of one method, it is much easier to present other methods and make them intelligible to his mind. It is a most important factor in didactic teaching to so drill the student that he may have an operation or process described and be able to put the ideas into practice. This mental grasp is to my mind the chief difference between the school- and the office-educated young man. To illus-

trate, we will consider the subject of impression-taking. This is the first technic work the student is given to do. After he has spent a few days in taking impressions and making plaster casts, his mind is in a receptive condition to grasp all we have to say upon impression materials and methods. In fact, he is quite sensitive upon the subject. It should always be borne in mind that the large proportion of our students are not accustomed to lectures. We give a definition for an impression, as, "A negative likeness of an object or a part to be reproduced in form." It is not sufficient that a definition shall be repeated two or three times, but it must be analyzed: "An *impression* is a negative, not positive; the object is to produce the positive and have a perfect reproduction in form, or a *cast.*"

Another very important thing at this time is to teach the student how to take notes. Without this instruction the probability is that the student will never read what he has taken, and would not understand it if he did, because the notes would be fragmentary. I instruct the student to draw a perpendicular line about one inch from the left side of the sheet. I then instruct him to write all subjects on the left of the line,—in a word, if possible,—the subdivision and short notes on the right.

In the first two or three lectures I write out the notes upon the blackboard as I am lecturing. Then for a few lectures I mention the subjects, divisions, and subdivisions,—when I feel that all who are interested in taking notes have established a method. To illustrate: The subject, "Impression," is written upon the left of the line; then opposite, at the right of the line, is written the word *Defined.* As this definition is not found in the text-book I request the students to write it out. The one word reminds the student that a definition was given, and if he does not remember it and it is not written out he must look it up in his text-book. Upon the left write, "Materials." Opposite, "First" and "Second." *First* Materials softened by heat; and *Second,* those made into paste with water and hardened by crystallization. (Name materials after each.) Then each material is treated as a subject, as, Wax,—treated under the subdivisions: How obtained, chemical symbol, solvents, melting-point, adulterants, how made into sheets, how removed from cloth, how worked; and so on through the list. The result will be that the student will have the teacher's notes, with

almost no time consumed; he has not lost the connection; can at any time review the lecture, and it creates a demand for his text-book.

Another feature to be considered is the keeping of attendance. I use this method, and like it better than any with which I am acquainted: At the close of the lecture I pass slips of paper about three by four inches in size; I give several to the man at the end of each row of seats; he takes one and passes the rest to the next man. I then ask for a short classification, definition, or the spelling of a technical term, which they write, sign their name, and hand in as they pass out. This requires but a moment of the class time and is an index to the comprehension of the student as well as a record of attendance. The name is afterward checked off in a book.

The subject of quizzing requires careful consideration. I believe that it should be used as a method of teaching and not as a form of examination. I give two lectures a week prior to the holidays, and one lecture and one quiz per week after New Year's. I may at any time during a lecture ask a question, but this is designed to fix the attention upon the point under discussion. My reason for not introducing the quiz earlier is that the class may have covered all of plaster, vulcanite, and some of metal plate-work, so that the student has some knowledge of the general subject of prosthesis; then the quiz becomes a review, and the student associates ideas which he did not do on first going over the subject. At the beginning of the term the student's mind is so engrossed with histology, osteology, and chemistry that it is wrong to require a preparation for a quiz upon this subject. The various subjects are taken up and quizzed upon in the order in which they were lectured upon, hence the student knows what to prepare.

Formerly my whole object in quizzing was to teach, and the students, knowing that it made no difference with their percentage, would sometimes take advantage of the method. I have known a few men who would persistently respond, "I don't know." I noticed that these men were very assiduous in writing down the question and perhaps a short answer. I have this year announced that a record will be kept and for "poor" to "very poor" recitation five to fifteen per cent. will be deducted from their final examination.

It is my opinion that the technic, didactic, and practical teaching should be entirely in the hands of one man; the technic and practical work may be in the hands of assistants, but they must be in entire sympathy with the professor, they should be men that have been educated to the work under him, so that no conflicting methods will be introduced.

By these means we will have harmony, and "In union there is strength."

DISCUSSION.

Dr. Grant Molyneaux. The very excellent paper presented by Dr. Wilson I think appears at a most opportune time. In a measure the paper is disappointing, in that it does not deal with prosthesis, as I see it, in any particular. I have made a few notes since receiving the paper, and I will try as briefly as possible to make myself clear as to what I consider prosthesis. If there is any department of dentistry at the present time that, more than the others, needs special attention from the intelligent part of the profession, it is that of dental prosthesis. The paper contains very many good suggestions, especially regarding the attitude of the teacher toward the student; how to impress him professionally, and how to find out what he knows and what he does not know. To know your students is a very important item in the teaching of any department of dentistry. After a brief perusal of the paper I am led to believe that the essayist has fallen into the error of many others, in that, judging from his text and his illustrations, he is teaching matters which are wholly mechanical as dental prosthesis. The melting of wax, dissolving it, molding it into sheets, the softening of modeling compound, and all other matters of this nature pertaining entirely to the dental laboratory, are matters that should be taught as dental mechanics, not as dental prosthetics.

I believe that, for the welfare of the students, we should as teachers perfectly define the subject now under discussion. We have in the college with which I have been connected a department of prosthesis, and we teach the mechanics of prosthesis, dental mechanics, orthodontia and palatal prosthesis pure and simple, and the making of splints. The connected mechanical matters. the construction of appliances, etc., may be left in the laboratory, and may be under the head of prosthetic dentistry, but they are

not prosthetics. Orthodontia cannot be mentioned in connection with prosthetics, nor the making of splints, nor the treatment of cleft palate, unless coupled with the substitution of artificial teeth. By such a division we attach to the term dental prosthetics a special significance, in that it means the substitution of artificial teeth, and involves the constant knowledge of the conditions that obtain with the patient,—not in the laboratory, but with the patient. The substitution of teeth involves many principles: health, comfort, function, restoration of function, as far as possible, contour, and all of that. These are things that must be considered incidentally to supplying function, which is the main objective point. The man who handles the patient at the chair takes an impression, and sends it two squares away and has a model poured. (I use the word "model"; Dr. J. Bond Littig has used the word "cast," and I tried to make a distinction once in that regard, but I fell from grace. I think the word model is much better to use than the word cast.) The model comes back; he molds a wax plate over it, builds up a bite of wax and sends it back for the teeth to be set up and the plate finished. It comes back and he places it in the mouth. Who is the prosthetic dentist,—the man who made that plate or the man who is putting it in the mouth? I say the man who made the plate is the mechanic; he can't be anything else, and he assumes to treat a case which he has not seen. The man who put that plate in the mouth is the prosthetic dentist. Mechanics is only conducive to the requirements. Health, comfort, restoration of function, conservation of tissue and all that that implies, must be uppermost in the mind of the man who is handling the patient, and he must know how to trim that plate; he must know where to bring his bearings. This is an important item. Mechanics may be made conducive to the requirements by careful and thorough mechanical technics.

Didactic instruction has been placed by the essayist as of greatest importance in developing the true professional man and in imparting underlying principles. "Technique and practical methods develop the artisan." Yet I observe that the essayist ends the lectures, which he considered of such great importance, with the first year, continuing the technique and practical methods which produce the artisan into, and well through, the second year; then he takes up orthodontia. It has been my experience

that the first-year students are not, as a body, capable of grasping any but the most elementary principles. I have been informed that in some schools the freshman is not admitted to the prosthetic clinic, *i.e.* where he may see the demonstrator handling the patient, or may by observation get some idea of the tissues of the mouth or general characteristics of the face. In this case the discussion of principles would have very little value; they could not possibly make an impression upon a student. If he is allowed to enter the clinic while the handling of the patient is entirely in the charge of the demonstrator or the professor or his assistants, his attention will be attracted to certain conditions. After such a clinical course, and a thorough technical training, the mind of the student is prepared for, and can be impressed with, a discussion of some of the principles which should apply to dental prosthesis; and these subjects should be illustrated as far as possible. I believe in the second year didactic instruction will be of greater benefit than in the first year. Recitations in this department I believe, with the essayist, to be of little benefit, except that after considering principles which we would take up in the second year, we *might* assume a hypothetical case and have the students discuss that case in the room. Now, you call on any student to discuss that case, and if he doesn't start right, the professor calls him down and gets the next one until someone does start it right. Quizzing is always an important factor in teaching, and a quiz should be prepared and used judiciously. I agree with the essayist in his general statement that the lecture, the quiz, class-room demonstration, etc., are methods that should be employed in teaching prosthetic dentistry, or in leading up to the teaching of that branch.

We are now about to enter upon a four-year course, and it appears to me that if we ever hope to place this department on the plane that it deserves, we must arrive at a more uniform method of teaching, as to subject matter and as to when the several subjects shall be taught. And above all, that in the teaching of any of these departments or divisions we shall use a more definite nomenclature than that expressed by the essayist. I do not believe that a prescribed course should be laid down, *i.e.* so far as to prescribe the hours in any department, the number of lectures, the number of quizzes, etc., but I do believe that we can harmonize

to some extent upon a proper division of the subject and of the matters taught under the heading of prosthetic dentistry. The method to be employed in presenting these several matters to the students must be left to the individuality of the teacher or teachers. The illustrations given by the essayist of his method of teaching are valuable because they are suggestive. I will use one of them because it will enable me to enforce the thought uppermost in my mind in this discussion, *i.e.* the necessity for a more accurate classification. The essayist says, "My object in not introducing the quiz earlier in the class is that the class may have covered all of the plaster, vulcanite, and even metal plate work, so that the student has some idea of prosthesis." I would like to ask Dr. Wilson if he can teach students to make dentures of gold or vulcanite and handle patients in three months of instruction. Is it possible?

Dr. Wilson. I start them, but they are not finished by any means. They do not handle the patient.

Dr. Molyneaux. It is not possible for me to teach students to do that in that length of time. I have been teaching for quite a number of years. I never was able to make a student in three months able to take hold of a patient and take an impression and construct a piece of prosthesis. If Dr. Wilson means the mechanical operations involved in prosthesis, or that will be later applied to prosthesis, that he has performed in the laboratory with vulcanite and brass on dummy models, then I say he is teaching only mechanics, and the subject should be handled as dental mechanics, not as prosthetic dentistry. If you impress the student with the necessity of accuracy in performing each mechanical step, telling him that each small detail will have a bearing in the final construction of that denture, he will look forward eagerly to the time when he can study the mouth and when he will be instructed how to modify and apply his technical instruction to the practical insertion of a piece of prosthesis. At this time the thorough discussion of the underlying principles will be of immeasurable value. The lecture, as such, is of very little importance, to my mind, during the first year, so far as prosthesis is concerned. But I do most emphatically believe in a thorough course of mechanical technics, employing all forms of every conceivable variety of base or material, so as to acquaint the student's mind with the mechanical details of handling these materials, and pointing out

from time to time some little practical point so as to keep his mind anticipating something further, until he has been trained to know how materials should be handled so as to produce accurate results, so far as mechanical manipulation is concerned. The method I employ has been to cover the freshman, junior, and senior years partly with instruction. I am supposed to be the professor of prosthetic dentistry, but I do not treat of palatal prosthesis, orthodontia, or splints as dental prosthetics. We take up the vulcanite base; we construct as many forms as I can imagine so as to give the technique of the apparatus and materials employed, but it is not called prosthetics, because a student takes it only from dummy models. The junior year is devoted, of course, to technical crown- and bridge-work and lectures on the principles of dental prosthesis. In this course we illustrate with models and charts and with a lantern, and use as many phases of the mouth as we can produce from our past experience that will act as suggestive measures to the student in the future.

In Cincinnati Dr. Webster presented a model of flexible vulcanite, and I had some words to say in connection with that subject on another line. So far as I know, Dr. Webster presented for the first time to the profession flexible vulcanite for the purpose of teaching the use of separators and the use of rubber teeth. At that time I said that I had used roller compound. I believe the first time that roller compound was presented to this society was by myself four or five years ago, and the first time that I have any knowledge of the presentation of roller compound was by Dr. Templeton in 1889, and since that time many will recognize that I have used roller compound for the duplication of models. I have here a model which I made yesterday afternoon to illustrate what I mean by phases of the mouth, and I say that flexible rubber, as suggested this morning, used in the prosthetic department as suggesting a principle, will not hold. It is all right in the operative department, but if you want to demonstrate a principle mechanically, so as to impress your students, you must have something that will reproduce the conditions of the mouth as nearly as possible. I give this model to the student and say, "Take this model and study it, and then apply the treatment of relief to prevent fulcrums and so as to insure adaptation and the proper bearings, etc.; take this and follow out the lectures and study it."

I have done that, and it was presented by me years ago at the state society meeting in Ohio, and also at this society several years ago.

The last half of the senior year is given to instruction mostly on the artistic side of prosthetic dentistry and to palatal prosthesis and instruction in continuous-gum work, every point of which is illustrated in every step through the different operations. And when I speak of the artistic side I do not mean that I talk about temperamental relation, but I show faces and show edentulous jaws and show the different physiognomies, man and woman, and give some suggestive ideas of the modification of the rules, as to how they must be modified to suit the various physiognomies. Dental splints, etc., are also taught, because I have had some training in that line, and I teach them in connection with some other things, but I only teach the mechanics of splints. We try to present as many varieties of cases as possible, with conditions as near as possible to those in the mouth, and supplement this with clinical training at the chair. The method employed by the essayist to keep a record of attendance at lectures seems to be very good. So far as note-taking is concerned, some students can take full notes and others cannot. To make this matter uniform to the class, and in the freshman year, especially, where you cannot lay down absolute rules in prosthesis, but in mechanical work, I append a little squib on vulcanite. The student takes a full upper model, constructs a base and a denture and then gives the successive steps of that; and then a full lower, and then finally supplements that with a list of the instruments and apparatus used. To make this matter uniform for the class the blackboard is used, and after each demonstration these steps are placed on the blackboard.

In concluding this discussion I feel that it would not be out of place to repeat a sentence from an article by W. S. How upon the mechanics of dentistry. "Word meanings change or vary through customary or incidental usage, therefore the thoughtful speaker or reader has not only to select words for his purpose, but he should be definite in attaching to certain phases of words the precise significance that each word is designed to impart." I believe this suggestion is opportune at this time.

Just one other thought. Dr. Guilford said this morning that it

is not difficult to find teachers of prosthetic dentistry, but that it is difficult to find teachers of chemistry. I would like to ask Dr. Guilford if he can point out a good teacher of prosthesis. I will say that prosthesis is not understood; there is not a more staggering subject in the dental profession to take hold of. I will say there is a great deal to prosthesis, and I know little about it. I am trying to know something about it, but it is a very deep subject and I like to take the broader view of it.

Dr. H. M. Kirk. In Dr. Wilson's paper there is much to commend and but little with which to take issue. In his first paragraph he has made a statement which I think is marvelously near the truth. He says, "In my own mind I am satisfied that the teaching of prosthesis is the most important subject in the dental college curriculum." The late Dr. Bonwill often made the statement that the mechanical skill and manipulation, such as is needed and developed in the dental laboratory, is the very basis of successful dentistry. But prosthetic dentistry is a much neglected and subordinated department of dentistry. It is neglected by the dental profession in general; by the student in college (after he has passed his initial year), and even by the college itself. I might have stated the fact more correctly if my declaration had begun at the other end, and I had named the college first, then the student in college, and then, as a result, the dental practitioner. I am not putting it too strongly to assert that there is too great a tendency on the part of the college and the laity to gaze admiringly at operative dentistry as through the right end of an opera glass, while they glance disparagingly at the prosthetic branch through the same glass reversed, and seem to see nothing there of very great attractiveness or importance.

This is not as it should be. These two great copartners of dentistry should stand abreast, and move aggressively forward. Prosthetic dentistry is the peer of operative dentistry, and, when indicated, is just as important. Making a denture is just as respectable, just as useful, just as remunerative, as filling a tooth or constructing a bridge; and to-day there are effulgent bridges in many mouths where there should be partial dentures. There is no excuse, in an effort to subordinate prosthetic dentistry, for asserting that, because all effort should be directed to saving teeth rather than replacing them with substitutes, operative dentistry is

greater than prosthetic dentistry. That saving teeth is better than ruthlessly destroying them, no one will gainsay; but so long as there are edentulous mouths, or mouths partly so, where bridges are contraindicated, just so long prosthesis should be and must be practiced. It is just as important, then (in these particular cases), and just as necessary, as the most perfect filling or the most beautiful bridge; and should be executed according to the most approved methods and in the most skillful manner.

It is not a valid excuse, nor always an honest one, for neglecting prosthetic dentistry that operative work is clean work, and prosthetic work is less so. It may be true; but is prosthetic work any less clean than the mechanical part of bridge-work? Made in the same room, nearly the same materials used, with the same surroundings, and perhaps at the same bench and lathe. Few men making that plea will refuse to make a bridge, or several of them, if the opportunity offers. What a man is able to do, he generally likes to do; and what he likes to do, he is generally able to do well. The main reason, I believe, that the average dentist does not like prosthetic work is, that not understanding it and its principles well, he has but small success in practicing it, and consequently he very naturally fails to fall in love with it, but would seek a divorcement from it. True, our tastes, our capacity, our mental endowments differ. Some students will not, others cannot, learn prosthetic dentistry.

Many students in colleges, many of our laity, and a greater number of those to whom we might refer as dental charlatans, not understanding the beautiful principles underlying this class of work, have very vague ideas as to what really constitutes an artificial denture. They are apt to think of a set of teeth as a piece of vulcanized rubber, made over most any kind of an impression, with a few artificial teeth upon it, arranged in a horseshoe shape, thereby hoping for good luck; no thought of esthetic taste, or of the other features which should be identified with an artificial denture. As for metal dentures, they have none to make, nor could they construct one if they had an opportunity. It has never been intelligently and sufficiently demonstrated to them that there are underlying and cardinal principles which govern the construction of an artificial denture, just as there are in filling a tooth or making a bridge. Many times, in the college laboratory,

have I seen an awakening on the part of the student to the real science and beauty of prosthesis; as he was being assisted individually through the mysteries of a practical case, he saw more in mechanical construction of the jaws, arrangement and articulation of the teeth, than he had ever dreamed of before. With the knowledge of these comes to a great degree the ability to use them successfully. It is in the province of the college to awaken the student to the beauties, possibilities, and profits of prosthetic dentistry. Ay, it is the college's duty! But it can never be done so long as the college fails to provide the means for doing so.

The essayist, with all of us, realizes the great responsibility resting upon the teacher of prosthetic dentistry during the first year, but seems to fear lest the dental youth develop into "the other extreme, a mere mechanic." Fortified by the other first-grade studies, I am not afraid that too much mechanical ability or artistic taste is likely to be infused into our students,—at least, I have never yet seen a serious case of it. On the other hand, I have wished many times for an exhibition of greater accomplishment along that line.

The essayist says, "The lecture we place as the most important of the didactic methods for producing professional men." The statement should be qualified. The history and successes of many institutions of learning, both literary and professional, will not bear out this unqualified statement. Much also depends upon the branch of learning taught.

But very little prosthetic dentistry can be taught the student unless he can carry out in a practical way the principles promulgated in the classroom. Precept upon precept, line upon line, here a little and there a little, must be applied to technical and practical work, else he will not learn to make a successful denture. Evidently the essayist does not believe as strongly as I do that teaching should involve much "seeing things done." For he asks, What mechanic could not do a thing which he had seen done? He himself indorses the idea. I believe that "seeing a thing done" is valuable. There should be more individual demonstrating in our dental college system. Were I to teach a student prosthetic dentistry on one line, either by didactic methods or by individual technical instruction in the laboratory, I would choose the latter. As we are to use both methods, the more indi-

vidual technical instruction we give the student the better it will be for him!

The essayist raises his voice against the recitation plan, but approves of the quiz system. I cannot see but that they are essentially the same. If the quiz be a good system, as the doctor admits it to be, then the recitation plan should not be condemned; for both systems (1) Strengthen the memory of the student and stimulate study; (2) Administer to his mental alertness; (3) Keep him trained in detail work. I believe that in many studies in the dental college, and more studies in the medical colleges, the recitation plan will bring the best results. In our own college, where the recitation plan is used almost exclusively in the classroom, our students are uniformly successful before examining boards wherever they go, even many before entering the senior year. This is due to the detail work in the recitation plan. The essayist says: "It always impresses me that the recitation applied to mature minds is an acknowledgment of inability and unfitness upon the part of the teacher." While our students are not kindergartners, at the same time we cannot assume that they are of mature mind. Quite immature I regard them, especially as far as their chosen profession is concerned, at least during the first two years at college. If the recitation be the best plan for immature minds, then it should be a success during the first two years at college.

The student must know his lesson *well* before he can rise in his place before a company of fellow students, and answer the questions put to him by his teacher.

I *do* believe that the opportunities for successful recitation in prosthetic dentistry are limited, when compared to many other branches taught, and our own judgment and experience should be our mentors. A short period for recitation and review, each day of class, I believe to be better than waiting till after the holidays, as has been suggested by Dr. Wilson.

He says, speaking of practical work, that "Perfection in this department is in one sense the aim sought by other methods, and can justly be considered the last step in making the finished operator." I would like to emphasize this. But at this point the college itself has a duty to perform. I refer, first, to the equipment, and second, to teaching corps. By necessary equipment I do not

mean a lot of worn-out vulcanizers and knock-kneed lathes, and other equipment which was only ordinary in its palmiest days. The demonstrators should be employed on account of the largeness of their knowledge, experience, and personal fitness, and not on account of the smallness of the salary for which they may be employed. With Dr. Wilson, I believe that they should be men of character, able to inspire in the student admiration for themselves, as well as for the branch they are teaching; *men,* in full sympathy with the plans and desires of the professor, not men who would in any manner hinder him, or make slighting or suggestive remarks about him, in the hearing of the students. With the demonstrators, it must be remembered, more than with the professors, lies the responsibility of training the student to be a dentist unless the professors be given the opportunity of being their own demonstrators, with an able assistant or two, which plan I believe to be ideal.

As does Dr. Wilson, we use the blackboard for defining the steps in all requirements. One requirement at a time, step by step we go, the whole class moving through this requirement-tactic much like a military company on dress parade. Thus it becomes to the student a gradual unfolding of a beautiful theory, which later on will surely enlighten their realm of practice. We need painstaking teaching, not grinding out requirements as quickly as possible, in order to get them off our hands. There is a disposition to teach prosthetic dentistry in too short a time. The first year is not too long to teach vulcanite work in all its phases, arrangement and articulation of the teeth, and thus allow metal work to form a part of the second-year work.

The practical work of the college lies usually with the junior class, although it belongs properly to the senior year as well. But the average senior is far above prosthetic work. He lives on a higher plane, a more ethereal habitation, in a world of operative, and crown- and bridge-work, which best suits his tastes and capacity. It being, then, almost impossible to have the senior come down from this lofty perch, the practical and technic instruction of the student in prosthetic dentistry really ceases with his junior year. Up to this time he may have made two or three practical cases in prosthesis. By the time he has finished his senior year, he has inserted fifty or seventy-five fillings of all kinds,

and several bridges. At the end of the college course, in what department of work, do you think, is he most proficient? Certainly not in prosthetic work, unless his instruction has been of the best.

In general, vulcanite work forms the great bulk of artificial dentures. Hence the first year devoted to vulcanite should be very comprehensive, and but little metal work should properly be done in that year.'

I like Dr. Wilson's note-book system, and too much cannot be said or done in support of the taking of notes systematically. Dr. Wilson says, "The subject of quizzing requires careful consideration. I believe that it should be used as a method of teaching and not as a form of examination." But he concludes the paragraph with the statement of a system of merit-marking which practically makes his quiz an examination after all! But this is right. Recitations should embody both ideas, examination and teaching, and marks of merit should be given, which may have a bearing upon the student's work for the year.

Dr. Wilson's method of keeping attendance is unique, and undoubtedly efficient, if not too bulky. It is a move in the right direction.

A summary of the main points would be:

(1) The acknowledged importance of prosthetic dentistry, both *per se*, and as a help in development of manipulative skill in all departments of the dental art.

(2) The duty of the college to the student, in providing the proper men as instructors, from the standpoint of ability, experience, and character.

(3) The duty of the instructor to his students and to his college, in devising the best plans for teaching and in using any or all methods that his judgment and experience dictate.

(4) The use of technic work, and plenty of it, as a preparation for the more important practical and professional work.

(5) The systematic taking of notes by the student, with leaves gleaned from the instructor's book of experience.

Regarding and interpreting these to the best of our ability, we will do wonders in the uplifting of this department of the dental art, and in rescuing it from the hand of dental prosthetic charlatanism.

Dr. A. O. Hunt. I want to be as brief as possible, because I always notice the same condition when the subject of prosthetic dentistry is up for discussion before a body of dentists, or even dental teachers, and that is that it is wearisome. It calls out little or no interest outside of those who have been engaged in its teaching; the rest don't like it, they don't care for it, they haven't the slightest interest in it. I desire, however, to make a statement, which, whether it be true or not, is my conviction,—that it is impossible to make a good dentist unless he be grounded thoroughly in the subjects that we classify under the name of "prosthetic dentistry." I don't care what specialty you may choose to practice, prosthetic dentistry is absolutely essential to the success of a dental practitioner. The evidence in the history of the profession is ample to prove that statement beyond any question. All the great men that we have had in the profession, with but one exception that I know of, have laid that foundation in the laboratory and along the lines of practical laboratory experience.

Now then, what are we here for? What are the colleges organized for? They are supposed to be able to give better training than a student can obtain in an office; it should be better. Our sole purpose is to make a successful, competent, thorough, well-informed dentist who can take care of the human family, and bring comfort and satisfaction to it by improving the condition of the oral cavity. We have but two subjects to teach as the final ending and rounding up of all our work, comprehended under the titles of prosthetic and operative dentistry. (We have lately grown to a specialty in orthodontia; also oral surgery has always been more or less of a specialty.) But our purpose is to make dentists. Hence, I say, whether it is true or not, it is my conviction that it is an utter impossibility, from my experience, to make a dentist until you teach him thoroughly, systematically, everything that comes under the head of prosthetic dentistry. I am not going to discuss and define the different reasons for it, but the freshman student comes to you to become a dentist. What of prosthesis, what of restoration of the human face, what of the final ideas or purposes can you teach in the freshman year? Nothing. You must teach what? He is starting in to become familiar with a class of material that he has never touched before. If it were simply the manipulation of that material, he could learn

that in an office just as well as anywhere else, but we are teaching chemistry, metallurgy, anatomy, and all of these other sciences around this main purpose, and everything that is taught in these branches that can in any way be of assistance in bringing the freshman student to a clear understanding of the material that is used, is all that you can accomplish in the first year. There is no science in that, further than that all things are scientific that deal with facts.

Now, then, teach him everything there is to know about the material he is going to use: why we use plaster of Paris instead of something else; why we use ordinary beeswax. We use modeling compound,—it is made up of various substances that he is not familiar with. All of this the student in his freshman year should understand thoroughly, not only the chemistry, but to know exactly what each substance is in its chemical and physical characteristics, and why it is used. I don't care how you teach it. The essayist says we start the student with impression work. What's the use of starting with impressions if you have not a well-defined purpose in view? He is not going to take impressions of the mouth to make dentures for some little time. If he does anything, let him do it for a purpose. If he takes an impression of a fellow-student's mouth, he gets a model of the human mouth, with the natural teeth in position. Now here is the keynote to dental prosthesis,—to know the position, the relation, the arrangement of the natural teeth. And here is the first thing he sees of dentistry, the model that he makes from that impression, and so far as I can judge from the essay, that is the end of it. The only purpose, seemingly, is that he shall put some material in another student's mouth and get an impression and make a model, and then it is laid away. In teaching the use of these materials you should have a purpose in view, *i.e.* teach step by step why they are used. By and by he will make a full denture. He is going to arrange some teeth for that denture. What is his guide going to be? If you want him to carve a tooth, you give him a tooth to imitate, you give him some idea of what he is going to do. Now, why not use these models that he has made and in duplicate cut the teeth off one of them. It is immaterial what kind of a model he works on; it is the idea of illustrating to him the human teeth as they stand in the mouth. But here his next-door neighbor may have a set of teeth with some peculiarity about it; let him imitate that.

And when in his second year he comes to where he begins to deal with the patient, he is not yet ready to be taught what is necessary in the restoration of the human features, because he has not studied those things. Here is the time, however, to begin the application of his anatomy, the function and location of every muscle of the face until he becomes familiar with how they operate. The study of the character of mouths,—as Dr. Molyneaux has set out here a flexible model which indicates the conditions which he finds in the human mouth; as he has also said, here is the time to instruct the student that he must not destroy tissue. Every mouth, gentlemen, is a study. There is no possible way that I know of whereby you can teach a student to make one denture, having made which he then knows how to make any other. Every case that he treats, every case that he comes in contact with, is of an individual character, and in his second year is the time that the instructor should point out to him some of the things that he is going to carry to completion when he knows something of prosthetic dentistry. One of the papers said that probably prosthetic dentistry was the least thing that any graduate from a dental college knows, and unfortunately that is true. Now what? Is it the fault of the student? Do you think it is? I say No. There is no class of student material that goes into any occupation that compares with that which enters a dental course. Did you ever think about it, gentlemen? There is not a tool or an instrument used by any artisan of which we do not use the counterparts,—not one. It is necessary, then, to teach students how to use these tools.

The study of the human face he comes to in his third year. The human individual stands up before him as something to deal with; he begins to realize that he must do something to make that individual at least as good-looking as he was before he lost his teeth. Now we come to the art of prosthesis, pure and simple. Everything before this has been technics or mechanics, all of which is just as important as anything that is taught. He must study the human family in what relation? Here is a room full of people, and if there were twins here it would make no difference, there is constant variation. Now what are you going to do? If you make a set of teeth for an individual, you must make it to suit that individual. Away back in the beginning of your work in

the freshman year you have had the student begin the study of these conditions, all the way along using models for teaching purposes that were taken by him from actual conditions. You cannot in any other way have the student understand. You do not understand yourself without that kind of study what it means to arrange a set of teeth. They are not all alike,—they vary; positions vary, conditions vary, variation is the constant law. More than that, it is possible to demonstrate to the students in their senior year, and not before, that there is an absolute relation between the face, the lips and cheeks, with the position of the teeth in the mouth; there is a positive relation to be demonstrated. This is dental prosthesis; the restoration of the human face to its normal condition.

We are all the time discussing method. I wouldn't give that much for method! Any man in this room will find a method if he knows the principles. I will trust any dentist that I ever saw in my life to make such a thing just as well as you or I can make it, if he knows what he wants to make. He won't follow the same method that you do and it won't make any difference! Look back through the profession. Plenty of men that you send a patient to will construct an artificial denture that is satisfactory, and yet you ask that individual to tell you what he did and he cannot do so. He has learned how to do it under great difficulties, persisting for years and years before arriving at the point at which he could take any patient and make for him a satisfactory denture. Now, gentlemen, the science of dentistry rests upon more than that; that is technical skill; we all have plenty of it. We can invent; we can make any sort of a thing, as was said in the paper, if we see it done. Now I have no criticism to make, but I would rather be compelled to think about things. You must think out the principles. The whole system of education of the world rests upon that. We are in a narrow field; we are following within narrow lines; we are not reaching out and getting familiar with the systems and principles that underlie the educational systems of the world. There were those long before we became teachers who found out what was necessary to draw out the human mind for the purposes of education. The writer says that the teacher should never be a taskmaster. Well, who is to be the taskmaster if not the teacher? Who is the man to hold a student down to his work, to make him do it just as he is told to do it? The student

is not the judge of what he is to do. So far as laying down any method or way of teaching is concerned, that seems to me like an impossibility. Each teacher must find his own way of conveying to the mind of the student the ideal that he has in view. If he has no ideal, he had better not teach; if he has one, he will find his own best way of imparting that knowledge to the student.

The essayist also made a criticism on the recitation and quiz. Our president in his address defined, at least to my idea, what I think to be the purpose of a quiz, *i.e.* to find out what the student does not know, not to find out what he does know. The recitation system, however, if carried out properly, has a purpose that has not been mentioned. The great difficulty with dental students, in my experience, is to get them to read. They don't like to read; they don't like to study; they are perfectly willing to have you show them anything. Now the recitation system is a means whereby the student is compelled to read more, perhaps not as much as he ought, but it is a means that will urge upon him the necessity for reading more than he would if you confined it entirely to a quiz. So far as the grading or standing that you may give a student is concerned, that is a personal matter.

The question was brought up as to the relation of orthodontia and prosthesis. The finger manipulation of individuals is often discussed. Of course, it goes without saying that a dentist must have this kind of instruction. In the making of appliances, no matter what they may be, they have necessarily been classed under the branch of dental prosthesis, without in any way meaning that it is prosthesis, only that that is the general term used now throughout the colleges to express a certain department; it used to be mechanical dentistry. Thank the Lord we got rid of that, but there still remains too much of the mechanical idea. But, gentlemen, it seems to me that whatever fault there is lies with us and no one else. There must be something wrong here; there must be something wrong in the teaching. If it be a constant thing that students going out of dental colleges can sustain themselves creditably in every other part of our work except dental prosthesis, then surely something is wrong. And there are only two things that we teach, leaving aside the other points that I have mentioned, and those are operative and prosthetic dentistry. We don't teach prosthetic dentistry as well as the operative people

teach operative dentistry, and that is where the fault is. We don't understand our subject so well as they do. It is a larger field; it requires the teachers of that subject to go out into all the fields of science, nearly, to get the material to use and apply it to this little narrow profession of dentistry.

Dr. W. C. BARRETT. Dr. Hunt thanks God that he is rid of the idea of mechanical dentistry. I feel that there should be a distinction made between prosthetics and mechanics in colleges. They are confused. I like the old word mechanics. I love a mechanic. I wish I were worthy the name of a mechanic. There is nothing in the world I admire so much as when I send for a workman to do something about my house which requires mechanical skill and he does it in a strictly mechanical manner. A plumber will come and make my home almost uninhabitable because he is not a mechanic. There is a vast difference between prosthesis and mechanics. Prosthesis means the substitution of natural tissues or organs by artificial ones. Crowns and bridges are spoken of here as belonging to mechanics. They are strictly speaking prosthetic work. The artificial teeth themselves are prosthetic appliances; the plate which sustains them is entirely mechanical, unless it is used for the substitution of a lost alveolus, or other missing tissue. A wooden leg belongs to prosthesis; an artificial velum is prosthetic; a glass eye is prosthetic. But I like the old idea of mechanics to express technic skill and manual dexterity, and I wish the dentists would use their language with better discretion than they too often do at the present time, and that they would not speak of prosthetic ability and skill when they mean mechanical expertness. Dr. Molyneaux made the proper distinction. So did Dr. Hunt in one moment, and then the next he thanks God that he is able to abandon it. He takes pride,—and so do we,—in the fact that he is something more than a mechanic. With all the sanctity of the pious Mussulman, who at noonday alights from his camel and spreading his prayer rug upon the burning sands of the desert, kneels with his face toward the holy city and with uplifted hands cries, "Allah! O Allah! In this shadeless land thou art my shelter," so does Dr. Hunt, in the honest fervor of his professional sanctity with uplifted eyes thank God that in this land of mechanical pretenders there is a sure refuge for the professor of facial art. I would that his devotion,

sincere as it is, were more properly directed, and in that aspiration let me enter my protest against the pagan worship of prosthesis, and here erect an altar upon which I may make my sacrifices to the mechanic arts and the mechanical idea in dentistry.

Dr. S. H. GUILFORD. Dr. Barrett is perfectly right when he draws the line of distinction and gives a definition in regard to what prosthesis is. It is the replacement of a lost natural part by an artificial appliance. Dr. Molyneaux did not seem to think so, for his idea was that it requires something artistic. It may or may not. You construct a crown or piece of bridge-work and it is prosthetic work; it is the restoration of a lost part by means of an artificial appliance. It does not necessarily imply that the one who makes the part must do it in a thoroughly artistic manner. With his idea in mind, Dr. Molyneaux asked me if I knew of a single prosthetic dentist in this country. Of course I do. We have men in our profession in this country who have true artistic ideas. You probably knew Dr. Essig, of Philadelphia, Dr. Kingsley, Dr. W. W. Evans, and others that I might mention who were or are artists in their way. They were not only prosthetic dentists; they studied the ethics of facial expression, and their highest ideal was the construction of an artificial appliance which would so restore the lost expression of individuals as to make them appear as nearly as possible as they did before their natural teeth were lost. That is the highest type of prosthesis. We haven't a great many of that kind, but I believe the time is coming when we will have more.

Dr. Hunt said that what he wanted was the teaching of these principles; he cared nothing for method. I don't understand that. He certainly must have some regard for method. You can't put a boy into a machine shop and tell him to do a piece of work without instructing him how to do it. That might develop individuality, but before you develop individuality you want to develop mechanical ability, and when the student comes to your college you must say to him, "I want you to do this thing in such a way," and then after he learns to do it in that way he may learn to do it in some other way. When students are placed in the laboratory I want them taught just how to do a certain piece of work. I want the demonstrator to say, "Do this in a certain way," and they are obliged to do it in that way. Why? Because it is a good

way. It is not the only way. After the student learns to do the work in one way he can try some other way. We all recognize the fact that it is impossible to take a student into the clinic and teach him to fill teeth in a great variety of ways. We haven't the time. It wouldn't do to say to a beginner, "I want this tooth filled; I will give you a certain amount of gold that I want adapted to the walls of the cavity," etc. You must teach him how to introduce the first, second, and third pieces and all the rest, and after awhile when he becomes familiar with one method he will do it in some other way, and, as I said before, his individuality will eventually develop, so that, after all, method is at the bottom of it. We wish to teach all we can, but we must do it in an orderly way.

In regard to the teaching of prosthetic dentistry, I am glad to see that the essayist and those who followed him had in their minds the system which we have employed in our school for a long while, and that is, during the first year the student is taught how to do things mechanically. He doesn't see a patient. He is taught the use of tools, and how to do certain things, such as the making of experimental plates, etc., simply the mechanical part. That is the foundation. Then in the second year he studies the other part of it,—his relation to the patient and the individuality of the patient as related to the plate. First the foundation is laid in regard to dental mechanics. Our students are taught by the demonstrators who are over them in a comprehensive way what they are to do and how they are to do it, but they don't attend didactic lectures upon prosthetic dentistry until the second year. By that time they are able to appreciate the principles involved in the lectures. They learn the mechanical or technical part first and after that the practical portion with both the patient and operator as important factors.

Dr. A. O. Hunt. I do not want to be at all misunderstood. I wouldn't have you think for a moment that I disregard method. I simply said that I think each teacher will find a way of his own, but it is essential that one method should be taught to students all the way through in order to be systematic, explaining various other methods, but I really think that a professor should have a definite line of teaching to be followed as the one he wants. To that extent I am a great admirer of method, but I think too much stress is placed on it, and not enough in compelling students to understand principles better.

Dr. J. D. Patterson. I wanted to rise to my feet to state my approbation of the sentiment which has been expressed in relation to the pre-eminence of the prosthetic field of dentistry as compared with the operative. As I look at it, much of the best in operative dentistry is prosthetic. The highest of operative dentistry, which we class usually as prosthesis, belongs to the fine arts. The highest in art is sculpture, then music, then painting, and so on. In the restoration which we do in prosthetic work we approach the very highest, that of sculpture. The highest form of the fine arts is the reproduction of the human form divine, and when we do that in the mouth, then we are artists. And there is no question about the pre-eminence of the fine arts in the prosthetic part of dentistry, when compared with the operative. When we do the best that we can in prosthetic work we are able to make more mistakes than in the operative, and more fault can be found with the best result that it is possible to attain than in the operative. A great many refuse to do mechanical work because so much complaint follows even their best efforts. That is a thing that we must not pay any attention to, and I am very sure that I do not. I appreciate the prosthetic field and the difficulty of well rounding out that field. It requires more study, more painstaking, and more sleepless nights than any field of operative dentistry a man ever entered. And all that is of the highest in fine art in operative dentistry belongs to the field of prosthesis.

Dr. G. H. Wilson (closing the discussion). I thank you very much for the consideration of the paper. I believe this is the only paper so far in which we have been successful in having our good brother Barrett called out.

The first discusser was a little more inclined to splitting hairs than we expected, although we expected that, but we would like to have consistency. He made the distinction between mechanics and mechanical methods and prosthesis, and that the mechanics and the steps leading up to it should be taught in the first year, and then the finishing part the second and last year; and then he tells us that in the third year he teaches prosthesis and continuous-gum work. It strikes me that that is pretty near mechanics, just as well as vulcanite. But the idea should be that we must use means to accomplish an end, and of course we began at the beginning and worked up. The object was not to try to cover the whole ground, because prosthesis is an extensive field, but it was simply to state the beginning and leave something else for the rest to say, and we feel that it has been very nicely said.

THE TEACHING OF BACTERIOLOGY.

BY W. R. BLUE, M.D., D.D.S., LOUISVILLE, KY.

THE addition of bacteriology to the dental curriculum did not cause delight to the prospective D.D.S., and the teaching of him or her is no easy task. I do think, though, that in a short time the dental student will manifest as much interest in this branch as does the medical. I was much gratified, at the end of my course this term, to hear a number of my pupils say that they were sorry the course was over, as they were beginning to be interested in the subject. But all good things must have an ending!

To teach any subject successfully requires, first, the necessary equipment,—which I have, thanks to the directors of my college. Second, the attention of the student. This can always be gained by plainness of talk and demonstrations. Blackboard demonstrations in connection with the work at hand make the course all the more interesting to the student. Third, in bacteriology one must have pure cultures, good microscopes, good objectives, good stains, and last but not least, good light. Cut-and-dried specimens should not be used in demonstrating, except as a control of the bacteria under consideration.

After explaining the work in view in a general way to the student my first lecture covers cleanliness, the use of high-power objectives, condensers, light, preparation of cover-slips and slides to render them sterile, and the articles required of each student in the laboratory, such as stains, needles, labels, Bunsen burners, etc. After this the course is about as follows:

I. *Definition of Bacteria.* History of bacteria, touching on their minuteness and giving measurements in micro-millimeters.

Grouping. They are classified by their shape, *i. e.* globular, cocci, rod-shaped bacilli, curved or spiral spirilla.

General Morphology. Here we describe the structure of the bacterial cell. Bacteria are examined under the microscope in their natural state and stained to bring out their protoplasm and envelope.

II. *Reproduction.* Now is explained the rapidity of reproduction under favorable surroundings. Board demonstration of the method of reproduction is given, also of degenerative changes, such as involution, explained.

Spore-Formation. Board and microscopic demonstrations of this method are given, Bacillus tetani and Bac. anthracis, properly stained, being used.

III. *Motility.* Movements of bacteria are studied by use of hanging drops. Here flagella are explained and the part they take in producing movement in bacteria. No attempt is made to stain flagella in the course, as the time required to find them by every student in the class would carry us far beyond the time allotted to the course.

General Biology of Bacteria. Under this heading we speak of the growth of bacteria, calling special attention to the prime factors which must be considered in their growth: (1) Food supply. (2) Moisture. (3) Relation to gaseous environment. (4) Temperature. (5) Effect of light.

IV. *Death of Bacteria.* This is demonstrated by transferring dead bacteria to fresh media and their failure to grow. The subject of germicides, sterilization, and the part these play in killing bacteria, is touched upon here. Sterilizers of various kinds are shown the class.

V. *Preparation of Culture Media.* Under this heading the making of different culture media is explained. Culture tubes are shown in the sloped, upright, and deep form,—the last for cultivating anaerobic bacteria. Platinum needles, for inoculating tubes, are passed to class and their use explained. Also methods of separating aerobic bacteria by use of Petri dishes and Esmarch tubes.

VI. *Incubation of Cultures.* Incubator with gas-regulator and burner brought before the class and explained.

VII. *Non-Pathogenic Bacteria and Pathogenic Bacteria.* (A)

Non-pathogenic Bacteria: The higher bacteria are placed under this heading, Leptothrix racemosa and Penicillium glaucum being used in hanging drops and stained for demonstration. (B) Pathogenic Bacteria: Before taking up the study of pathogenic bacteria, the student's attention is called to the importance of destroying all infectious articles either by heat or chemicals. No food is to be eaten in the laboratory. Smoking is prohibited. No label is to be licked by the tongue. When fluid containing bacteria is spilt on the benches or floor 1:1000 mercuric chlorid is at once poured over the spot. Barring the Bacillus coli communis, only mouth-bacteria are dealt with in the course. All the varieties of pus-producing organisms are first shown and the part they play in suppurative conditions explained. These are followed with the thrush fungus (Oïdium albicans), diphtheria bacillus, tubercle bacillus, and actinomyces. Then come the bacteria that cause dental caries: (1) The acid-producers of superficial layers, *i.e.* Streptococcus brevis, Micrococcus albus, aureus, citreus, Spirillum sputigenum and Bacillus maximus buccalis. (2) Of deeper layers, *i. e.* Staphylococcus brevis and Bac. necrodentalis (Goadby). The liquefying bacteria of dental caries are next shown, *i. e.* Bac. mesentericus fuscus and Bac. fervus (Goadby) and yellow bacillus of Goadby. Only one bacillus that produces discoloration in caries is shown, *i. e.* Bac. mesentericus ruber.

VIII. *Microscopic Examination of Bacteria.* The two methods used are by hanging drop and film preparation; the first I have already referred to. Film preparation, dry method: This is the most common method of microscopically examining bacteria. The student is given a drop of sterilized, distilled water on cover-slip from platinum loop. Immediately afterward the bacteria to be studied are added to the water and stirred. Student evaporates the moisture and passes the cover-slip through the flame of the Bunsen burner three times to fix the film. Then the stain for the bacteria under consideration is announced, with full direction for its use. When practicable, each student is given specimen to examine suspected of containing bacteria he is studying in pure culture. (I make use here of pus from alveolar abscesses, sputum from suspected cases of tuberculosis and thrush.)

IX. *Inoculation of Animals.* When time permits, animals are

inoculated with some of the virulent cultures in stock. After death, post-mortems are held and pathological changes in different organs are made note of. Blood is examined for bacteria.

X. *Immunity and Susceptibility.* These subjects are treated at some length. Under this heading toxins and antitoxins are explained.

The last week of the course is devoted to the inoculation of culture tubes by each student, from particles obtained from the mouth. These tubes are labeled and incubated. Cultures are examined at the end of the third day by hanging drop and film method. Pure cultures, previously stained, are used as controls.

At the end of the course a general review occurs, when the micro-projector is used for the larger bacteria and lantern slides for the smaller.

DISCUSSION.

Dr. L. P. BETHEL. As Dr. Blue has asserted in his paper, it is no easy task to teach the subject of bacteriology understandingly. The majority of students know nothing whatever about the subject, and some have never heard of it until after entering college. It therefore seems to take a longer time for them to begin to comprehend this subject than any other branch taught in the dental course. Taking advantage of this fact, we begin the study of bacteriology in the Dental Department, Ohio Medical University, in the freshman year, devoting one hour a week throughout the year to recitations and supplemental talks, and begin the laboratory course in the junior year. By pursuing this plan the student has a clear comprehension of the whole subject before he begins his laboratory course, and he then goes to work understandingly and learns more from this practical laboratory work than he otherwise could. The students also do more creditable work in the laboratory.

In the freshman year the subject of bacteriology is taught in a general way, beginning with definitions and explanations as to what bacteria are, etc., followed by a short history of the discovery and study of them up to the time of the birth of modern bacteriology in the early eighties, and the progress made from that time up to the present. The subject is taught progressively, the blackboard and charts being used wherever their use seems an advantage. After covering the subject in general, bacteria of the

mouth are considered, the necessity for antisepsis, fermentation in the mouth, ptomain formation, and infection from the oral cavity explained, cultures made from the mouths of students are grown and passed around for inspection, etc. Twenty-seven hours are devoted to recitations, demonstrations, and talks on this portion of the work, three and one-half months being given to general, and three and one-half months to special bacteriology.

At the beginning of the junior year the student commences the laboratory course. Each day an outline of the work is placed on the blackboard for students to copy into their note-books, and an explanatory talk given the class.

Following is an outline of the laboratory course given: Preparation of the different culture media. Study of hanging drop. Staining methods, simple. Staining by Gram's method. Preparation of Petri plates. Study of Petri plates. Preparation of pure cultures. Study of non-pathogenic bacteria. Study of pathogenic bacteria. Staining of spores and flagella. Examination of air, soil, or water. Study of normal mouth-bacteria. Ferments and fermentation in the mouth. Plate studies from pyorrhea alveolaris, abscess, and other pathological conditions of the oral cavity. Studies of bacteria found in caries of the teeth: (a) superficial layers; (b) deep layers. Growth and study of aerobic and anaerobic forms of bacteria found. Sections of decalcified carious teeth stained and studied. Caries of teeth further elucidated by means of lantern slides and projection.

Cultures studied in the laboratory are: Subtilis; prodigiosus; Kiel; rubidus; sarcina aurantiaca and lutea; fluorescence; proteus vulgaris and mirabilis; mesentericus vulgatus; Deneke; Finckler-Prior; Friedlander; pneumococcus; streptococcus pyogenes; staphylococcus aureus, albus, citreus; pyocyaneus; gonococcus; coli commune; typhoid; actinomyces; cholera; tuberculosis; diphtheria; tetanus; malleus; anthrax; lactic acid; yeasts; molds; and bacteria known and unknown found in the mouth.

The bacteria are studied on the different media. Diphtheria, on Loeffler serum. Pus cocci are isolated from pus by the students. Tuberculosis is studied from the sputum; anthrax by rabbit inoculation; tetanus by inoculation into mice, etc.

Realizing that you desired only an outline of the methods of teaching the study of bacteriology, I have purposely omitted

much detail, but this is a general survey of the course taught our dental students, and covers twenty-seven hours in the freshman year, and eighty hours in the junior year, making a total of one hundred and seven hours devoted to the subject.

Dr. George W. Cook. The essayist has very clearly and concisely given us his method of teaching bacteriology. He is the first medical man, doing work in dental schools, who has shown any special connection of bacteriology with dental teaching. Most all the teachers in the so-called scientific branches in dental schools have been in the past, and are very largely at the present time, recent graduates in medicine, many of whom are not even well acquainted with the common routine technique of laboratory work. For instance, I obtained culture media prepared by four leading medical schools, and found that the ordinary saprophytic bacteria would not grow with any degree of success, excepting one. I later learned that the janitor was making the culture media for these schools. A senior student from one of these colleges is now an assistant in one of our dental schools in bacteriology. The dental schools take one or two men of this stamp as teachers to dental students.

A teacher should be able to place before the student not only growing bacteria, but the cause of putrefaction, fermentation, and disease, remembering that two factors are ever present, the substance to be acted upon and the active agent. One of the points that should be brought out to dental students and explained is the phenomenon of anaerobiosis. Upon this question rest some principles of fundamental importance to the student, who will have ever before him the problems of fermentation and disease. This will lead far into the food question of bacteria, and the chemical means of destroying them. It is only necessary to give a few examples here. For instance, the non-pathogenic bacillus prodigiosus produces red pigment on substances, rich in starch, but if the temperature be raised a few degrees, a strong lactic acid fermentation will take place instead of the red pigment. The comma bacillus of Asiatic cholera causes disease in man, but when grown in sugar solution it produces lævorotary lactic acid and is non-pathogenic. The germ of butyric acid will produce butyric acid out of saccharose as a chief product, and butyl alcohol as a by-product. But when the germ is grown on media containing

glycerin, butyric acid and butyl alcohol as a normal product (and as a by-product propyl glycol and lactic acid) are formed. A great many more examples might be given similar to this of the physiological activities of bacteria. This is of the greatest importance to students in dentistry. Since bacteriology is one of the most prominent branches of the tree of knowledge, it cannot be neglected or slighted in dental schools.

When Paracelsus spoke of the seeds of disease, he must have had a foreshadowing of this bacterial question. When we consider that bacteriology is just struggling through from the natural history stage to that of a science, it is more readily understood why the true biological principles of pathology have been, and are to-day, so very imperfectly understood. One can very materially simplify his way of treating diseased conditions if his knowledge is based not only on mechanical but on scientific physiological principles. We can, from a clinical and experimental standpoint, say conclusively that there are chemical agents that cure disease, and that the inductive method is the only way in which it can be taught to students.

A student should start his bacteriological work in his junior year and should have completed the principles of histology and physiology. He should have had the elementary structure of a proteid molecule well fixed in his mind, thus giving him a good knowledge of how living things are built up out of the simple elements. He will then be able to grapple with the principles of the vital phenomena of bacteria, and their action on the chemical compounds with which they come in contact. Under this head will come the processes of putrefaction and fermentation, the latter of which the dental student should have well grounded in his course in dental education. The mere fact of growing bacteria, without thoroughly understanding the chemical activities and the metabolic changes they produce in the environing media, is not sufficient to give him the proper knowledge for the combating of disease, which is to be his future life-work. A teacher should grow such bacteria as will enable him to show all of these various processes. This will be considered by many teachers as entirely too much work for the limited time allotted to its study.

When the student comes to his senior year, he should have a pretty thorough knowledge of disease, and the bacteria that he

has to combat in practice. It is easy to teach him pathology, giving him a thorough understanding of those germs known as parasites, and their action as disease-producing organisms, at the same time teaching him the difference between those low forms of vegetable life, known as bacteria, and those parasites that belong to the animal kingdom, known as protozoa; explaining the difference between their disease-producing functions, while you are showing that the last forms here mentioned cannot, as yet, be cultivated artificially as bacteria. When this is done, we will begin to place the subject of bacteriology on a scientific plane, where it belongs, and the subject of pathology will then be on a scientific biological basis. As long as dental schools are placed upon a commercial basis, so long will dentistry be considered an art instead of becoming a progressive scientific profession. The sciences have everywhere struggled through a mechanical and sometimes a monistic stage, and to-day dentistry is on the borderline between a science and an art.

The question of text-books I have not mentioned. This is one of the stumblingblocks in the teaching of bacteriology and pathology. The only text-books that it is possible to use at the present time are those on general bacteriology and pathology. We want a text-book from a man who has had at least ten years of study and experimental knowledge along with teaching these subjects. A book cannot be used written by a man who has scraped a small particle from a tooth and sent it away to some laboratory, and called this a scientific analysis of the subject in question. A book could be gotten up, containing three hundred and fifty or four hundred pages, which should not cost a student over three dollars, but this is going to take an immense amount of research and the study of the literature that is constantly being brought out from the laboratories all over the world.

Gentlemen, I do not believe so much in the extension of the time of study for students as in the extension of time and preparation of the teachers who are to teach these students. A teacher in any of the scientific branches should devote, at the least calculation, not less than one-half of his time to teaching and study. What can we hope from a teacher,—say, for instance, a busy practitioner in dentistry or medicine? The medical man who has three or four cases of typhoid fever and perhaps six of

diphtheria cannot give much time to reason out why the streptococcus chains grow longer in the saliva of one person than in that of another; to the future dentist this will mean a great deal.

These remarks are not intended as a reflection on our essayist, for I know him to be a painstaking bacteriologist, and in his paper he has shown himself to be ambitious in giving the students of dentistry the very best knowledge possible.

Dr. W. C. Barrett. The curriculum of dentistry has broadened and widened so much within the last few years that it is no wonder that it is necessary to extend the term. Human research is adding so much to human knowledge that the short time employed in teaching dentistry in the past has been entirely insufficient to do more than give a superficial glance at the technique of a few of the studies which the dentist should pursue.

Bacteriology lies at the base of pathology. It is but a few years since the first instruction was initiated in pathology, under the old two-year system of instruction of about five months, taking two weeks to pry the thing open and two weeks for vacation and two weeks to screw it shut, left about three months of good solid instruction to the student in each year. All of the pathology that was taught was included in the chair of operative dentistry. At the present time most of the schools have established a chair of pathology, and the dentist is taught that he is, to a certain extent, pursuing medical science; that he belongs to one of the great curing arts; that it is his business to cure disease and to wipe out that which induces changed pathological conditions. This is a wonderful change within a few years. If the dentist is simply a mechanic, he is no more a professional man than is the shoemaker. The dentist, if he is simply a mechanic, must understand something of the anatomy of the human mouth and teeth; that doesn't make him a professional man. It is when he begins to study the curative art and to treat pathological conditions that he rises to the level of what is commonly conceived to be a professional man. By that I do not want anyone to understand that I belittle this mechanical portion; that is one part of dentistry.

Bacteriology lies at the base of most of the pathological changes that take place in the oral cavity, hence no man can practice the dentistry of to-day and comprehend the dentistry of

to-morrow unless he has pursued a good course in bacteriology. It is one of the basal studies, or should be one of the basal studies in the pursuance of a dental course, as much so as anatomy is in its own field. I don't mean to introduce any comparison between them, but I say that in pathology a study of bacteriology is as essential as a study of anatomy is to the pursuance of surgery. It is a considerable number of years since I began to teach didactic bacteriology. I never have prepared myself or made any special studies in the technique of the laboratory courses. My own course has been to commence the study of bacteriology in the junior year, giving the didactic work at that time, and a full course of lectures, as competent a course as it was possible for me to deliver on the strict subject of bacteriology, going back to the very classification of matter and taking up the roots which underlie and permeate the basal structure of the whole study. Then in the senior year comes the laboratory course. With that I have never connected myself. I have been teaching the didactic portion of bacteriology in the Chicago College of Dental Surgery for a number of years and the laboratory course has been carried on by someone else. It is the same thing in Buffalo, practically. There the laboratory course is taken in the senior year. I believe it belongs in the senior year. When we get to the four-year course it will be in the sophomore and junior years, but at present I think it belongs, from my standpoint, in the junior and senior years. Unless the student is thoroughly versed in the elements of mechanical science and becomes fully acquainted with the basal principles in the freshman year, he never gets it. He gets to the junior year and there are so many other things to take his attention that he will not devote his time so exclusively to the mechanical aspect of it as he should. When he gets to the senior year it is out of the question. Hence the freshman year with us, is mainly devoted to the elaboration of the mechanical portion; the junior year commences the scientific study, and the senior year gives the laboratory course. And, gentlemen, there is no study which is taught in either of the schools with which I am connected which seems to absorb the attention of the students so much as does that of bacteriology. There is none in which they are so greedy for information, so far as my knowledge goes There is no study, so far as my knowledge and observation extend,

to which they devote themselves with more enthusiasm than to bacteriology.

I am very glad to have listened to the paper, and also to have listened to the discussion arising from it. When shall we as teachers rise to a comprehension of the fact that dentistry is growing, spreading wider and wider, and that the courses in dentistry require a preliminary education that shall enable the student to comprehend the basal principles of science; that he shall not learn his A B C's after entering the dental college, and that he must be thoroughly instructed in all of these principles which are so absolutely essential to the pursuance of any professional course? I tell you, gentlemen, we don't half comprehend it! We are just engaged in our own field, and that which is nearest our eye excludes the light from that which is farther away. I tell you we have to take broader views; we have to become wider and more comprehensive in our studies, and to remember that a dentist is no longer a tinker, he is no longer a bellows-mender, but he is to pursue scientific studies along those lines so closely intermingled with the basal principles which he must understand, as bacteriology.

Regarding the last paper that was read, I am inclined to think the author has fallen into the error of a great many. He is a little puffed up with the idea that he is a bacteriologist, and the impression produced upon my mind was that he rather attempted to confound us with a multiplication of technical terms which were very badly expressed and prevented our getting the sense of what there was in the paper, provided there was any sense there. I wish that we would, as dentists and as everything else, use the English language. We can't avoid using technical terms, but what is the use of calling a spade an agricultural implement when we will so much better comprehend it if we speak of it as a spade? And when we use a complication of technical terms, with which so few of us are familiar, there is a mixing up, there is a shadow over our meaning; it is completely involving outside matters with that which should be comprehended, so much so that it becomes as clear as mud sometimes. I wish that everyone who writes on such subjects as this would use common-sense language and common language and use no more technical terms than they are obliged to.

I believe the first paper to be a very careful and clear statement of a good, competent bacteriological course which is sufficient for the wants of to-day. To-morrow we will want a postscript, we will want another addition, because we will have advanced and we will have become able to comprehend and understand higher, better, more complicated things.

Dr. G. V. BLACK. I would like to add a word to this discussion, and in the outstart let me say that we should not blame the bootblack if he converts a verb into a noun and uses it in expressing his intentions when he says, "Have a shine, sir?" It is the language of his craft, and we readily come to understand him. Now, gentlemen, let us apply this to dentistry, and when we teach dentistry let us use the language of the craft, and if we do not understand that language it is our fault as dentists. In other words, when we name things in dentistry, whether it be in operative dentistry, whether it be in pathology, or whether it be in bacteriology, let us use the language of that subject. In no other way will we be enabled to understand it. If we do not understand the names of things that are applied in that subject we will fail to understand it.

Dr. BARRETT. Let us not pretend to use technical terms when we do not understand them.

Dr. BLACK. There are some who do know them. Unfortunately, there are many who do not yet know them. Let us learn them, and we, as a profession, will not learn them until those of us who do know them call things by their right names, nor will we understand the things of which we speak until we call them by their right names. Gentlemen, I stand for a better understanding of the nomenclature of these subjects, that this nomenclature should be taught as we name things that we present to students,—name them correctly, that is all. Not that nomenclature should be taught so much as a separate study from the things we are teaching,—that is not the right way,—but to present the thing and properly name it as we present it. This is the way in which to teach nomenclature in connection with any subject. And in this subject of bacteriology, particularly, we are greatly at fault for want of careful pursuit of the nomenclature that is handed down to us. Here is one of the difficulties I have found in following our esteemed Dr. Miller. It has always been a

source of great discomfort to me that he failed to name the bacteria of the mouth as he went on with his work. I understand full well the reason why he did not do so—the difficulties that were in the way, the difficulty of selecting suitable names, and yet it has been a stumblingblock ever since,—the fact that he did not give to the specific bacteria which he isolated and determined, specific names which we could apply. If we had these names sharp and clear and the diagram of the different organisms written out in sharp and clear terms, we would have much less difficulty in studying the flora of the mouth to-day. I wish we had these names. I have been compelled myself to give them names such as would answer my purpose, understanding with myself that these were more or less temporary, and I have avoided in a degree using them in the general writing that I have made on this subject, because I felt that they were necessarily temporary.

Now as to the specific course that should be pursued in teaching bacteriology in dental schools. We have much more than we can do at the present day to give students a fair idea of the flora of the saliva, and it has been my thought that we should confine our work pretty closely to this flora. I feel that we are going too much into the general pathological bacteriological work to give our students the time they should have in the study of the flora of the saliva. There is a reason for this in the lack of text-books. The text-books that are available to our teachers are the text-books of general pathological bacteriology. We have not as yet a text-book that we can follow in the studies of the mouth and from the mouth, and yet I should prefer to take my students into that field, even with a lack of text-books, than into the general field of pathological bacteriology. The teacher who can isolate and point out these organisms, the several organisms that are of importance, and there are not so many of them, will have done good work. It is true that Dr. Miller has isolated some sixty or more varieties from the saliva, but we know very well that these are gathered from day to day as we are passing through the street, as we are passing from room to room; they are gathered in the saliva and come out in this cultivation; they will be mostly the ordinary saprophytic micro-organisms. The division of these from the pathogenic organisms of the mouth, those that may produce caries, inflammation, pus, is an interesting field to the

student; particularly does the isolation of those that produce acids, taking them directly from the students' mouths or from the patients in the infirmary, become a field of the greatest interest to the student. And then the student should learn something of the conditions that arise in the mouth directly as a result of their growth, from a direct study of the mouth and cultivation from the mouth. It has been my habit in the cultivation before my class to take almost the entire list directly from the mouths of my students in the class and let them see the results of these growths as illustrated in the lecture course in bacteriology. It is easy to do this. It takes a little time, but when one gets hold of it so that he may change an alkaline medium into an acid medium by planting from the mouth of the student, showing the change in color by the use of litmus, and various things of this kind that will interest the student, that will have a teaching force, it will in this way do the student much more good than a general survey of general pathological bacteriology.

In examining the courses given in these papers we find that it is almost exclusively the course given in the medical schools in the general pathological bacteriology, rather than a course selected for the dental student to illustrate the general principles of bacteriology in the mouth. We will not cultivate from the mouth long until we find the principal organisms, and very soon we will find that we have a very large proportion of the list that is important to us in the general field of pathological bacteriology. We will show in this way the presence of these disease producing micro-organisms in the field of our own work. Instead of taking them only from the laboratory, then, I insist that we isolate them directly from our own field of work. Why not isolate the bacteria from carious dentin; why not isolate them especially from the deeper portions of carious dentin, and show our students what is going on there, in this short course that we must give them?

Now, I would urge upon those who are teaching bacteriology in dental schools that they take these freshly extracted teeth with actively progressing caries, and isolate the micro-organisms from these, make the general or mixed growth first, then plate them out and get the individual species from caries, get the individual species from about the necks of teeth, the individual species from the masses that grow about children's teeth, from young adults'

teeth and from old persons' teeth. Get the variations among these; then in the broader methods we may illustrate those micro-organisms that do not grow upon culture media. Here is a field of work that is so neglected that I wish to speak of it particularly; for we have, as most of us well know, a number of species of micro-organisms growing in the mouth habitually that are undiscovered by methods of culture and by the ordinary microscopic examination, because of their transparency, because of their failure to take color by the ordinary staining methods. By the special plans, however, that have been developed by Dr. Miller we can use special staining methods and get views of these and find that they are growing in profusion in the mouth. I think it is important for students to know that there are micro-organisms not discoverable by the ordinary methods, and also that probably there are many species of micro-organisms growing in and about our field of work that are not discoverable by any method yet known to us. This becomes absolutely certain as we go on, for we find results that are evidently bacterial and yet we are unable to find the bacteria.

Now, I wish to insist upon it that we turn our attention more directly to the immediate field of work in which we are engaged in this bacteriological study rather than take up material exclusively from the general field of pathology.

Dr. J. D. Patterson. The work that I do in this field comes after the work that has been outlined in these papers. I take up the function of bacteria in pathological conditions, especially in the oral cavity, and the methods by which we may attain immunity from their growth and action. Dr. Black seems to bemoan the fact that our nomenclature and designation of different classes and subdivisions of bacteria is limited, and says of Dr. Miller that he has criticized him because he does not give us enough indicative nomenclature. Afterward he says that Dr. Miller has isolated and named sixty different bacteria in the mouth. I think he is getting along pretty well.

There is a question upon this whole field which has interested me and which is very seldom spoken about, and that is that bacteria, especially some classes of bacteria, change their power and function. One bacterium with a certain ability to produce disease will, on account of the food or the medium in which it

grows, change into another class. To my mind this is one of the most interesting fields which the pathological bacteriological field has brought before us. For instance, a few years ago we had one specific micro-organism in the production of dental caries. Now how many have we? Even Dr. Miller himself acknowledges that there may be four or five, and Dr. Choquet, of Paris, makes the broad statement that any of the bacteria may become acid-producing and caries-producing. Here is a question which is of interest,—that the character of bacteria, what they do in producing disease, depends greatly upon environment and what they consume. When gorged with food, they take on all sorts of forms. Then why shall not a coccus take on the form of a rod, or a rod the form of a spirillum, and so on? I think there is too much attention given to finding a specific bacteria in dental diseases, and that we must in pathological conditions believe that a micro-organism, which at a certain stage in its life and growth has an ability to produce certain destruction of tissue, as the disease progresses the food and environment becomes changed takes on a more destructive character. I don't think there can be any doubt about it. We isolate and we say, Here is a specific bacterium found in a particular form of disease, and we claim it is specific. We do not know.

Dr. G. V. Black. I supposed I was understood when I spoke of the micro-organisms of the mouth and the numbers isolated by Dr. Miller. I want to say plainly, then, that the accidental varieties found here are many; the flora of the mouth proper are few and we may almost count them on the fingers of our two hands. It is not a multitude that we wish to isolate.

As to this matter of change in the species of bacteria. We know that there are certain changes that take place, but the student should learn to know that when he gets the color of the golden rod he has the *Staphylococcus aureus*, and that he can never get that color in any culture of the *Staphylococcus albus.*

Dr. J. D. Patterson. Where in the beginning of the life of that micro-organism did it get its coloring matter?

Dr. G. V. Black. I don't know, sir. There are lots of things we must take as facts in science without an explanation. We know that there are certain species that run through a cycle; all of that is true, but let us not go too far with that and make state-

ments that would confuse students. Here is the insect that runs through a cycle of different developmental stages. We may find the same thing practically among the micro-organisms, and our students should be taught that such is true. But in this running through of these different cycles of existence there is a regular order of sequence, and there is a regular order of the production of by-products in accordance with the material upon which this or that organism grows. But these are regular things; they are not irregular or accidental, and our students should come to know that if I plant the streptococcus media or the "alpha" of Miller in a broth that contains sugar we are sure to get acid as a result. If I plant that in a broth that has no sugar, we are just as sure to get no acid as a result. These things are definite and certain, and they are teachable. We cannot explain the facts, but they are simply definite facts. Then, as there are only about a dozen species, say, of the destructive flora of the mouth that are habitually there, it certainly is not such a large undertaking to develop them for students.

Dr. W. C. Barrett. I would like to ask Dr. Patterson if he habitually, in his teaching, uses the word "eat" in connection with the proliferation of micro-organisms.

Dr. J. D. Patterson. I rise to a point of order. The gentleman is out of order, because he desires to ridicule instead of getting at a point of science.

Dr. A. E. Webster. I am not particularly interested in any department of the discussion, but in the teaching of bacteriology there is one question which arises in my mind, and that is, Should we proceed from the pure culture or from a mixed culture? I thought I had that clear in my mind before I heard some of the remarks, and now I am not so clear as to whether we should proceed from what is actually known, or begin with the mixed culture. It is very essential in a bacteriological laboratory to know which way to proceed, from the general to the particular or from the particular to the general.

Dr. G. V. Black. From a mixed culture, always, as you find it in nature.

REPORT OF EXHIBITS, ETC.

REPORT OF MASTER OF EXHIBITS.

Mr. President and Gentlemen:

Following customary precedent, I desire to report the following colleges as having made exhibits, with brief description of each:

University of Pennsylvania.—Teaching methods, illustrating the progressive steps in the prosthetic procedures, plate, crown- and bridge-work.

Louisville College of Dentistry.—Students' work, graded. Printed outline of course.

Indiana Dental College.—Students' class work. Rubber teeth mounted in soft rubber base.

University of Buffalo, Dental Department.—Juniors' and seniors' work; also teaching methods.

College of Dentistry, State University of Iowa.—Mechanical work, freshman year. Teaching methods in the operative procedures.

Chicago College of Dental Surgery.—Freshman and junior exhibit in plate and crown and bridge technics.

Dental Department, University of California.—Metallurgy technics.

School of Dentistry, University of Illinois.—Class work, instruments, carving and dissecting of teeth.

New York College of Dentistry.—Class work, plate, and orthodontia methods.

Pennsylvania College of Dental Surgery.—Teaching methods and class work.

Northwestern University Dental School, Chicago.—Freshman class work, instrument forms, carvings, and dissection of teeth.

Ohio College of Dental Surgery, Department of the University of Cincinnati.—Class work, plates, bridges, crowns, orthodontia.

Pittsburg Dental College, Department of the Western University of Pennsylvania.—Teaching methods and class work.

Dr. Weeks: Papier-maché models.

Dr. C. T. Bryant: Technic tooth forms.

Dr. Barnes: Orthodontia methods.

Respectfully submitted,

H. W. Arthur, *Master of Exhibits.*

Improvements in Teaching Appliances.

MILWAUKEE, WIS., December 30, 1901.

DR. GEO. E. HUNT, PRES. INST. OF DENTAL PEDAGOGICS, PITTSBURG, PA.

My dear Mr. President: I find myself, at the last moment, unable to attend the meeting of your association. I cannot however, entirely forego the pleasure of presenting for the consideration of your members two improvements recently adopted in the technic courses of the Dental Department of the Milwaukee Medical College. One of these, a model of which has been sent forward in care of Dr. Cattell, is a flexible rubber cast or jaw devised by Dr. Raymond J. Wenker, in such a way that the sockets are prepared for the insertion of any kind of teeth that may seem best for the student's purpose. We believe that no practice in the preparation of tooth cavities, and filling the same, is so beneficial as that done in natural teeth or their nearest substitutes, in carved ivory. We also feel that neither rubber nor celluloid teeth can be used to equal advantage, therefore in our opinion the ease with which both roots of natural teeth and those ivory carved can be inserted into the sockets of Dr. Wenker's rubber casts and firmly secured, renders this method a decided improvement upon others that have from time to time been suggested along the same line.

The second idea is shown by a crude example, which I send directly to you and which is a result of some experimentation by Dr. Percy B. Wright, of Milwaukee, who teaches prosthetic technics in our college. It is especially designed and used for orthodontia technic work. Teeth can be arranged in any desirable form of irregularity, the tips imbedded in plaster to hold firmly in position, and the flexible material, which melts at a very low temperature, poured about them and allowed to harden. Orthodontia appliances can be adjusted under direction of the instructor, and the misplaced teeth actually straightened by proper application of force. We find it extremely convenient, easily handled by students, and most desirable because natural teeth can be used without injury, while the material, being nothing more or less than modified printer's roller, can be procured very cheaply. Dr. Wright has spent a good deal of time during the past year trying to make suitable change in the crude material. The result is that he can produce it with any degree of stiffness from that of the accompanying sample, which is quite soft, to almost any desirable firmness, and if any of your members feel sufficiently interested, I have no doubt a letter of inquiry will bring the fullest explanation from Dr. Wright. Yours sincerely, GEO. V. I. BROWN.

Dr. BYRAM. Last year I promised several members of the Association at Nashville that as soon as I learned of a better method of constructing the *flexible rubber dummies* I would let them know, and I have been asked about it several times since I came. But until Dr. Bryant took hold of the work recently, we had no better method, and I want also to heartily indorse Dr. Bryant's new production of vulcanite teeth.

MINUTES.

SEVENTH AVE. HOTEL, PITTSBURG, PA.,
TUESDAY, Dec. 31, 1901.

THE ninth annual meeting was called to order at 11 A.M., with President George E. Hunt in the chair.

The roll call showed twenty-one colleges present. The total attendance at the meeting was forty-five.

Dr. J. A. Libbey, of Pittsburg, delivered an address of welcome, which was gracefully responded to by Dr. D. R. Stubblefield, of Nashville, Tenn.

The report of the Secretary and Treasurer was read, and referred to the Executive Board.

The reading of the minutes of the last meeting was dispensed with, upon motion, since they had appeared in printed form.

Dr. D. M. Cattell, chairman, reported for the Executive Board that the proceedings and the program of the present meeting had been printed, and were in the hands of the members. President George E. Hunt called the vice-president, Dr. H. J. Goslee, to the chair, and read his address.

Discussion of the address was opened by Dr. J. Taft, whose comments were read by Dr. N. S. Hoff, as Dr. Taft was unable to be present. The discussion was continued by Drs. Kennerly, Stubblefield, Weisse, Whitslar, Barrett, Grant, A. O. Hunt, Webster, Black, Patterson, Kirk, and Hoff, the discussion being closed by the president Dr. George E. Hunt.

The president's address was referred to a special committee, to be appointed later, and to report next year on the subject of "Curriculum."

The meeting adjourned to meet at 2.30 P.M.

2.30 P.M.

The meeting was called to order by the president.

The following resolution was offered by Dr. Willmott, limiting the time of speakers in the discussions:

WHEREAS, Our time is limited, and straight talking to the point has ever been characteristic of this body; and

Whereas, Dispatch is necessary for the transaction of our business; therefore, be it

Resolved, That no one shall occupy the floor more than once to speak on any subject until all who desire to speak have finished, and then only with the consent of the body; and be it further

Resolved, That no one shall occupy the floor in the discussion of any subject for more than five minutes, except he ask for and receive the unanimous consent of the meeting, in which case he may then occupy another five minutes only; and be it further

Resolved, That the chair is requested to time each speaker and vigorously enforce this rule.

The Executive Board recommended that the name of the Dental Department, University of Illinois, be changed to the School of Dentistry, University of Illinois. Carried.

Minutes of the previous session were read, and after a slight correction were approved.

The symposium on "Executive Work of the Faculty" was opened by Dr. E. C. Kirk, of Philadelphia, followed by Drs. J. D. Patterson, D. R. Stubblefield, and T. E. Weeks. The general discussion was participated in by Drs. George E. Hunt, J. H. Kennerly, G. V. Black, H. A. Smith, and W. H. Whitslar.

Moved and carried that the subject be passed.

The symposium on "Classroom Methods of Teaching" was presented by Drs. N. S. Hoff, R. H. Nones, and L. S. Tenney. The discussion was continued by Drs. Hillyer, Grant, Weeks, Kenyon, Webster, Owre, Cattell, Byram, and Barnes, and the subject passed.

The chairman of the Executive Board announced that the evening session would be devoted to the paper by Dr. Black.

Adjourned at 5 P.M.

8 P.M.

Meeting called to order by the president.

Minutes of the afternoon session were read and approved.

Dr. G. V. Black then presented his paper on "Management of the Infirmary Clinic in Dental Schools." The discussion was opened

by Dr. Weisse, continued by Drs. Grant and Whitslar. The general discussion was participated in by Drs. Bethel, Barrett, Starr, Kenyon, Barnes, Dittmar, Goslee, and Byram, and closed by the essayist.

Adjourned at 10.40 P.M.

JANUARY 1, 1902, 10 A.M.

Meeting called to order by the president.

Minutes of the previous meeting read and approved.

A letter from Dr. G. V. I. Brown addressed to the president was read, and referred to the Executive Board for publication with the proceedings. (See page 158.)

Dr. H. W. Arthur reported, on behalf of the Local Committee, that a banquet had been prepared in honor of the Institute, to take place that evening at the Hotel Shenley, the members being requested to meet in the lobby of the Seventh Avenue Hotel at 8 o'clock.

Vice-president Goslee was called to the chair.

In the absence of Dr. J. H. Hodgen, his paper on "Teaching of Dental Metallurgy" was read by Dr. D. R. Stubblefield. The discussion was opened by Dr. J. P. Buckley and continued by Dr. Alfred Owre. General discussion by Drs. Kennerly, Hoff, Grant, Guilford, and Stubblefield.

Moved by Dr. Cattell that a committee be appointed to draft suitable resolutions upon the death of Dr. C. J. Essig, which was carried. The vice-president stated that such committee would be appointed later.

The Executive Board, through its chairman, Dr. Cattell, reported on some ideas presented in the letter, accompanied by models, from Dr. G. V. I. Brown, devised by Drs. Wenker and Wright.

Dr. Tenney presented models showing results of experiments by Dr. Bryant in making molds in metal for vulcanizing rubber teeth for technic procedures.

Dr. Barnes, of Cleveland, showed model and explained method of making detachable teeth, etc., for technic and orthodontia purposes.

Dr. Weeks showed his mammoth tooth models, and explained their use in teaching cavity nomenclature.

Dr. Hoff exhibited flexible model with vulcanite teeth.

Dr. Webster exhibited models, etc., showing carved vegetable ivory.

Dr. Guilford exhibited bone teeth carved in quantities by professional carvers, and also a metal form of jaws for mounting.

Adjourned.

2 P.M.

Meeting called to order by the president.

Minutes of previous session read and approved.

The president appointed as a committee on resolutions upon the death of Dr. Essig: Drs. Kirk, Barrett, and Weisse.

The application for membership of the New Orleans College of Dentistry was presented, and by *viva voce* vote the college was elected to membership.

Dr. G. H. Wilson then read his paper on "Teaching of Prosthetic Dentistry." Discussion was opened by Drs. Grant Molyneaux, H. M. Kirk, and A. O. Hunt, and continued in general discussion by Drs. W. C. Barrett, Guilford, and Patterson, and closed by the essayist.

The president appointed as a committee on the president's address, to arrange a four-years curriculum, and to report at the next annual meeting, the following: Dr. G. V. Black, chairman; Dr. W. H. Whitslar, and Dr. N. S. Hoff.

The committee on resolutions upon the death of Dr. Essig made the following report, which was adopted and ordered spread upon the minutes:

WHEREAS, This association has learned with deep regret of the death of Dr. Charles J. Essig; and

WHEREAS, By reason of his long and active career as a teacher, and his enthusiastic and energetic efforts to give dignity and high professional status to the specialty which was his life-work; and

WHEREAS, In the death of Dr. Essig this association has lost one of its prominent and devoted supporters; therefore be it

Resolved, That the Institute of Dental Pedagogics hereby places on record the high esteem which they bore for Dr. Essig as a man, and its recognition of his abilities as a teacher. We desire especially to record our admiration for the high ideals which both by precept and example he always inspired and inculcated in relation to dental prosthesis, and which have so largely helped to maintain for that important specialty its true professional relation.

Signed by Drs. EDWARD C. KIRK, W. C. BARRETT, and F. D. WEISSE.

Officers for the ensuing year were then elected, as follows: Hart

J. Goslee, president; J. D. Patterson, vice-president; D. M. Cattell, master of exhibits; H. B. Tileston, secretary and treasurer.

Dr. D. R. Stubblefield was elected a member of the Executive Board for the term of three years, to succeed Dr. D. M. Cattell, whose term expired.

It was announced that the delegates would visit the Pittsburg Dental College at 9 A.M. Thursday morning.

Adjourned at 5 P.M.

(The night session was omitted on account of the banquet given at the Hotel Shenley.)

JANUARY 2, 1902, 10.45 A.M.

Meeting called to order by Vice-president Goslee.

Minutes of previous session read and approved.

The paper by Dr. W. R. Blue on "Teaching of Bacteriology" was read by the secretary, Dr. Blue not being able to be present. Discussion was opened by Dr. L. P. Bethel, and continued by a written discussion from Dr. G. W. Cook which was read by Dr. D. M. Cattell, Dr. Cook being absent. General discussion by Drs. Barrett, Black, Patterson, and Webster.

Dr. H. W. Arthur, master of exhibits, then made a report which, upon motion, was received.

The retiring chairman of the Executive Board, Dr. D. M. Cattell, urged the members to come prepared at future meetings with written discussions of papers, to save the Board unnecessary work. He also asked, in behalf of his successor, for prompt reply to letters, and expressed appreciation of the work done by Dr. H. W. Arthur, master of exhibits.

Moved by Dr. Weeks, That the appreciation and thanks of the institute to the Pittsburg Dental College for the banquet at the Hotel Shenley be expressed by a rising vote; which was done.

The Committee on Operative Technics asked for the addition of Dr. Byram to that committee, which request was granted.

Moved and carried that the Committee on Prosthetic Technics be continued as at present constituted.

The report of the secretary and treasurer was approved as recommended by the Executive Board.

Dr. Weeks then presented the newly elected officers, who were duly installed.

A rising vote of thanks was passed to Dr. D. M. Cattell for his very excellent services as chairman of the Executive Board.

The minutes of this and the preceding sessions were then read and approved, after which the Institute adjourned.

Respectfully submitted,

H. B. TILESTON, *Secretary and Treasurer.*

APPENDIX.

List of Membership Colleges with Duly Accredited Representatives present, dues paid and entitled to vote.

Northwestern University, Dental Department.
College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Royal College of Dental Surgeons.
Dental Department, Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
Dental Department, University of Iowa.
Indiana Dental College.
Kansas City Dental College.
University of Buffalo, Dental Department.
Dental Department, University of Pennsylvania.
Philadelphia Dental College.
Pennsylvania College of Dental Surgery.
Department of Dentistry, Detroit College of Medicine.
Dental Department, Ohio Medical University.
Missouri Dental College.
Dental Department, University of Omaha.
Pittsburg Dental College.
New York College of Dentistry.
College of Dentistry, University of Illinois.
Dental Department, Medico-Chirurgical College, Philadelphia.
New Orleans College of Dentistry.

Membership Colleges without Accredited Delegates.

Dental Department, University of California.
Birmingham Dental College.
Dental Department, University of Tennessee.
Baltimore College of Dental Surgery.

Southern Dental College.
Atlanta Dental College.
Cincinnati College of Dental Surgery.
Dental Department, Marion Sims College of Medicine.
Dental Department, Milwaukee Medical College.
Washington Dental College.

Total membership, 35.

Colleges represented by delegates, 25.

Colleges without delegates, 10.

Colleges admitted at this meeting, 1.

Dropped for non-payment of dues, 1.

Respectfully submitted,

H. B. Tileston, *Secretary and Treasurer.*

TENTH ANNUAL MEETING of the INSTITUTE of DENTAL PEDAGOGICS held at CHICAGO, December 29-30-31, 1902

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PROCEEDINGS

OF THE

TENTH ANNUAL MEETING

OF THE

Institute of Dental Pedagogics

(FORMERLY NATIONAL SCHOOL OF DENTAL TECHNICS)

HELD AT CHICAGO, DECEMBER 29-31, 1902

SEVENTH VOLUME, PUBLISHED 1903

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PREFATORY NOTICE.

THE Publication Committee submits this report of the proceedings of the Tenth Annual Meeting without apology for having made an effort to present only the essence and substance of the discussions, believing that the exercise of such discretion will place on record a fair, liberal, and more interesting statement of the work accomplished.

A careful perusal of these proceedings should stimulate all dental teachers to attend the next meeting of the Institute at Buffalo, Dec. 28-29-30, 1903.

HART J. GOSLEE,
D. R. STUBBLEFIELD,
W. E. WILMOTT.

FORMER MEETINGS AND OFFICERS.

1893, Chicago—President, D. M. Cattell; Secretary J. A. Dale; Committee on Constitution and By-Laws, T. E. Weeks, H. P. Carlton, J. A. Dale.

1894, Old Point Comfort—President, D. M. Cattell; Vice-President, T. E. Weeks; Secretary and Treasurer, J. F. Stephan; Executive Board, T. E. Weeks, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1895, Asbury Park —President, T. E. Weeks; Vice-President, S. H. Guilford; Secretary and Treasurer, J. F. Stephan; Executive Board, D. M. Cattell, 3 years; N. S. Hoff, 2 years; H. W. Morgan, 1 year.

1896, Saratoga—President, H. W. Morgan; Vice-President, S. H. Guilford; Secretary and Treasurer, J. F. Stephan; Executive Board, G. H. Wilson, 3 years; D. M. Cattell, 2 years; N. S. Hoff, 1 year.

1897, Chicago—President, G. V. Black; Vice-President, N. S. Hoff; Secretary and Treasurer, D. M. Cattell; Executive Board, G. E. Hunt, 3 years; G. H. Wilson, 2 years; D. M. Cattell, 1 year.

1898, Cincinnati—President, N. S. Hoff; Vice-President, H. P. Carlton; Secretary and Treasurer, Hart J. Goslee; Executive Board, D. M. Cattell, 3 years; H. W. Morgan, 2 years; G. H. Wilson, 1 year.

1899, Philadelphia—President, H. P. Carlton; Vice-President, Geo. E. Hunt; Secretary and Treasurer, Hart J. Goslee; Executive Board, W. E. Willmott, 3 years; D. M. Cattell, 2 years; H. W. Morgan, 1 year.

1900, Nashville—President, Geo. E. Hunt; Vice-President, Hart J. Goslee; Secretary and Treasurer, H. B. Tileston; Executive Board, W. H. Whitslar, 3 years; W. E. Willmott, 2 years; D. M. Cattell, 1 year.

1901, Pittsburg—President, Hart J. Goslee; Vice-President, J. D. Patterson; Secretary and Treasurer, H. B. Tileston; Executive Board, D. R. Stubblefield, 3 years; W. H. Whitslar, 2 years; W. E. Willmott, 1 year.

1902, Chicago—President, J. D. Patterson; Vice-President, H. B. Tileston; Secretary and Treasurer, W. E. Willmott; Executive Board, R. H. Nones, 3 years; D. R. Stubblefield, 2 years; W. H. Whitslar, 1 year.

MINUTES.

The Tenth Annual Meeting of the Institute of Dental Pedagogics convened under the Presidency of Dr. Hart J. Goslee at the Palmer House, Chicago, on December 29, 30 and 31, 1902.

FIRST DAY.

MORNING SESSION.

The meeting was called to order by President Goslee at 11 a. m.

Dr. G. V. Black, of Chicago, delivered the

ADDRESS OF WELCOME.

MR. PRESIDENT AND GENTLEMEN OF THE INSTITUTE OF DENTAL PEDAGOGICS:

Nothing could give me more pleasure than to greet the teachers in dentistry of this great country of ours, in which dentistry is making such wonderful progress; where dentistry is leading the world. It is a pleasure to me to look into your faces this morning as you are gathered from the East and from the West; from the North and from the South, thus exhibiting your interest in the progress that dentistry is making, and I hope that the program that has been prepared for you will hold that interest from the beginning to the end of this meeting. I sincerely hope that this meeting will be marked as the most brilliant success which has ever attended the meetings of this association, the first association in the world to make the study of the teaching of dentistry its business. And to this glad beginning I most heartily welcome you.

I welcome you also to this great city of ours, a city that sprang up so quickly on the banks of what was once a little river, a city that the Indian designated as "much big teepee on little river," a city that has grown so wonderfully in its short period of existence. We welcome you to this city and to what it may have in store for you. I must caution you, however, that our chief magistrate and his police force are always on the alert, and if some of you should go a little astray toward the wee small hours of the morning, these

ever watchful guardians of the peace will run you in and take care of you. And while the boards at the station may be a little hard, yet the station will be warm.

Our weather man, too, can dish up almost any kind of weather you may desire, and at a moment's notice; furnishing several varieties during the course of one day, if you wish it, so that those of you who come from the sunny South may have frozen weather, and our friends from the bleak North may witness a genuine spring thaw, or any other kind of weather. Chicago is noted for the many kinds of weather it can dish up at a moment's notice, so that you will be both pleased and displeased as to the weather.

Now, we wish you to see and to hear. The different Dental Schools of this city will be glad to welcome you in their homes; the school on the South Side and the two schools on the West Side. Whether or what arrangements have been made for these visits, I do not know, but you will be welcome at any time. Although I have not as yet consulted the deans of the various schools, I think I can speak for them on that point without any hesitancy.

So I again heartily greet you. I am very glad you are here. I am very glad to see the bright and interested look in the eager faces around me, and I hope that during your visit with us you will have a royal good time, as well as do a great deal of good for the advancement of dentistry. Again, gentlemen, I welcome you. (Applause.)

Dr. A. O. Hunt, of Omaha, Neb., responded to this address of welcome, as follows:

RESPONSE.

MR. PRESIDENT AND GENTLEMEN:

It is always very delightful to be asked to respond to an address of welcome, but it is particularly pleasant to me when that welcome is given in Chicago. There is probably no other place in this country where conditions are so suited for a meeting of this character. We are in the center of what can justly be considered the largest educational center in the United States. And it is a fitting place for an association of dentists and dental teachers, and the fact that there is such a goodly number in attendance here at the very beginning of our meeting

makes the welcome doubly pleasing. But a welcome to Chicago involves a great many things. The speaker mentioned the fact of the police organization here being an efficient one. They are very busy and if you should undertake to find any of those Indians over near the mouth of the river that Dr. Black spoke of, you are very likely to run up against a patrol wagon or something of that kind. However, there is no place to my knowledge where the spirit of entertainment is so wholesome, so hearty and so good as in Chicago. Mr. President, we thank the gentleman very much indeed for his hearty welcome to this city. (Applause.)

The Secretary, Dr. Tileston, read his report which was referred to the Executive Committee.

REPORT OF SECRETARY-TREASURER.

Received Oct. 28, 1901, from former Treasurer, H. J. Goslee.	$ 58.84
Received dues from colleges for 1901 and back dues	440.00
Received collection charges on checks	.20
Received from H. J. Goslee, to balance account	10.00
Received from S. S. White Co., for stenographer	85.00
Total receipts	$594.04
Expenditures as per Ledger	288.23
Balance in Treasury	$305.81
Colleges admited to membership at last meeting	1
Total membership Dec. 29, 1902	35
Colleges whose dues are paid to current year	30
Colleges in arrears for dues for 1901	5

During the year the secretary sent out letters to all colleges not members of the Institute inviting them to apply for membership and sending each one a copy of the proceedings. Some favorable letters were received in reply but no applications have been sent in.

Respectfully submitted,

H. B. TILESTON,
Sec'y and Treas.

Dr. W. Earl Willmott, chairman of the Executive Board, reported that the program of the meeting had been printed and copies were ready for distribution, and that the proceedings of the previous

meeting would be distributed in a day or two. He introduced also the following resolution: "The reaffirmation of the report adopted at the previous meeting, that there be no smoking during the sessions of the association." Carried.

After a short recess, during which the various representatives of colleges were given an opportunity to qualify, the secretary reported that the Keokuk Dental College, of Keokuk, Ia., applied for membership in the institute. This application was referred to the Executive Board.

On motion of Dr. Willmott, the minutes of the previous meeting, as published in the transactions, were adopted. Executive Board also reported that the Constitution and By-Laws had been printed and were on the secretary's table.

At this juncture Dr. Thos. E. Weeks, of Minneapolis, took the chair, while the president, Dr. Goslee, delivered his annual address.

The discussion on this address was opened by Dr. N. S. Hoff, of Ann Arbor, Mich., and continued by Drs. S. H. Guilford, Edwin T. Darby, W. C. Barrett, T. W. Brophy, A. H. Peck, J. H. Kennerly, G. V. Black, D. R. Stubblefield, E. Noyes, G. V. I. Brown and W. E. Grant.

Here Dr. Grant moved that the entire matter of the president's address and the question of curriculum be referred to the committee on curriculum and that this committee report to-morrow when the discussion of the paper is to be continued.

Motion carried.

The Executive Board announced that the special order of business at 9 o'clock to-morrow morning would be a visit to the Dental School of Northwestern University. And that in the afternoon at 4 o'clock the schools on the West Side, the Chicago College of Dental Surgery and the School of Dentistry of the University of Illinois, would be visited.

After listening to a report by the master of exhibits, Dr. D. M. Cattell, the meeting adjourned until 2 p. m.

AFTERNOON SESSION.

The meeting reconvened at 2:30 p. m. and was called to order by President Goslee.

The minutes of the morning session were read and approved.

The roll call of colleges showed that thirty of the colleges members of the institute were represented. The total attendance at the meeting was eighty-six.

Dr. L. S. Tenney, chairman of the Local Committee of Arrangements, announced the arrangements for visiting the dental colleges on the following day, and also gave notice that the banquet would be held on Tuesday evening at 7 o'clock.

The Executive Board, by Dr. Willmott, recommended that the Cincinnati College of Dentistry be reinstated to membership in the institute.

Carried on motion.

The board further recommended the admission to membership of the Keokuk Dental College.

Carried.

The recommendation of the board that a flashlight picture of the association be taken was also carried.

Dr. Joseph M. Patton, of Chicago, read a paper entitled, "Teaching Physical Diagnosis." The discussion on this paper was opened by Dr. R. H. Hoffheinz, of Rochester (who, owing to inability to be present, sent in his discussion, which was read by Dr. Willmott), Dr. T. B. Hartzell, of Minneapolis; Dr. D. R. Stubblefield, Nashville, and Dr. A. H. Peck, Chicago.

The discussion was then further continued by Drs. Whitslar, Weisse and Borland, and closed by Dr. Patton.

On motion of Dr. Brophy, a vote of thanks was tendered to Dr. Patton for his very able paper.

An adjournment was then taken until 8 p. m.

EVENING SESSION.

The association was called to order by the president at 8:30 p. m.

The minutes of the afternoon session were read and approved.

At this juncture Dr. T. W. Brophy addressed the meeting as follows:

"It must have occurred to you all during the previous sessions of the institute that our president was laboring under a great deal of embarrassment. Early in the proceedings some speeches were

made, one in particular, before the time limit was fixed, and the chief characteristic of that speech was not only in the many good things the speaker said, but the enormous amount of time he took in saying them. Immediately afterwards there was quite a stir noticeable at the officer's tables, and the president, secretary and Dr. Willmott got together and fixed a time limit of five minutes for each speaker. Everyone who spoke, however, violated that rule by getting someone else, by a little diplomacy, to move that the time limit be extended. So that each speaker had ten minutes instead of five. Then the vice-president came to the chair and declared that the rules must be observed, and said that we should have some instrument by which this association could be controlled. I was called into consultation and I decided to carry out my part of the work.

Here (indicating) is an instrument for our presiding officer, not only for our present officer but also for those to come. It may be remembered that this association had its origin in Chicago, and it was in the Chicago College of Dental Surgery that the first work was done in operative and prosthetic technics. Therefore, we thought it would be quite appropriate for the college to present the institute with this gavel, and on behalf of the Chicago College of Dental Surgery, I present to the Institute of Dental Pedagogics a gavel for the purpose of holding in subjection the members of this most august body. It has been well made of enduring material, and it has been inscribed in a way that will impress those of us who are present at this meeting and, we trust, also who will follow us in the years to come. This gavel bears the inscription, "Docendo discimus"—we learn by teaching—"presented to the Institute of Dental Pedagogics by the Chicago College of Dental Surgery, December 29-31, 1902." (Applause.)

DR. H. J. GOSLEE:

DR. BROPHY, AND GENTLEMEN OF THE INSTITUTE OF DENTAL PEDAGOGICS:

I think that it would be but fitting that this beautiful gavel be accepted on behalf of the institute by one of its originators and organizers, and I therefore take pleasure in calling on one of the fathers of this society to accept this emblem of authority—Dr. Thomas E. Weeks.

DR. WEEKS:

MR. PRESIDENT AND DR. BROPHY:

I recall very vividly a remark I once made at a banquet at which some of you were present and which caused a great deal of merriment. When I arose to my feet to respond to the toast, I said that I was too full for utterance, and I might repeat that remark at this time. I scarcely know how to express my gratification about a number of things. First, and greatest of all, because of this great and glorious association which has grown from a very small beginning that was suggested by four or five, including myself. I hardly know who was the first to suggest it; it has been accredited to me, and not being over-modest, I am perfectly willing to accept all the glory. It was, however, beyond the wildest dreams of its originators that this association should ever wield the power and the influence in matters of dental teaching that it does to-day. I believe it is building and guiding the destinies of the dental profession of this country. I do not believe that I claim too much for the association when I make that statement. We should all, and especially that little band of technique teachers who started this institute and named it the National School of Dental Technics, be proud of the progress that this body has made and the work it has done in furthering the teaching of dentistry in all its branches. That is the first cause for congratulation.

The next is that you have selected me, Mr. President, not a member of this organization by right but only by courtesy, as I am no longer a teacher of dentistry, to accept this beautiful gavel from Dr. Brophy, my very valued friend. Dr. Brophy, on behalf of this society, I thank you and your colleagues of the Chicago College of Dental Surgery for this token of your generosity and good will. Of course, I do not suppose that you meant to insinuate that we were knockers (laughter) by giving us this "knocker."

Mr. President, allow me, on behalf of this institute, to present you, as the presiding officer of this body, with this beautiful emblem of authority. I know you will use it wisely and I hope that your successors will emulate your excellent example. (Applause.)

DR. GOSLEE:

As the presiding officer I accept this beautiful gavel with the belief that it will be wielded to the best interests of this body on

down through the days of its usefulness which, I am sure, will be many. This is indeed a beautiful gavel and the inscription also is beautiful, and I think it quite fitting that it should be presented to the institute on this its tenth anniversary by the college in which it had its birth. I accept this gavel with a great deal of pleasure, and I assure you that it will be wielded with every effort toward the best interests of this association.

Dr. C. N. Johnson, of Chicago, followed with a paper entitled, "A Systematic Arrangement of Lectures on Operative Dentistry."

The discussion was opened by Drs. W. S. Hosford, G. E. Hunt, H. W. Morgan, read by Dr. Stubblefield, and H. L. Ambler. The discussion was continued by Drs. W. C. Barrett, Smith, Marshall, Black, Stubblefield, Hunt, Grant, Patterson, and closed by Dr. Johnson.

In the absence of Dr. I. N. Broomell, of Philadelphia, his paper entitled, "Teaching Dental Embryology," was read by the secretary, Dr. Tileston.

The discussion was opened by Drs. W. H. Whitslar, J. J. MacKenzie and F. B. Noyes. Others who participated in the discussion were Drs. H. B. Tileston, G. V. Black, W. C. Barrett, G. W. Cook and F. C. Zapffe.

Chair extended cordial welcome to all members of the profession, whether teachers or not, to the sessions of the institute.

Subject passed by consent.

After a report by the Local Committee of Arrangements, adjournment was taken until Tuesday morning at 10 o'clock.

SECOND DAY.

MORNING SESSION.

The association convened at 11 a. m. with the president, Dr. Goslee, in the chair.

The minutes of the previous session were read and approved.

Dr. Tenny, on behalf of the Committee on Arrangements, reported that the banquet was to be held that evening, and that all the visiting delegates were the guests of the local profession.

Dr. Weston A. Price, of Cleveland, O., read a paper on "Teaching Electricity and Its Dental Uses."

On motion the discussion of this paper was deferred until the afternoon session.

Dr. F. D. Weisse, of New York, read a paper on the teaching of anatomy to dental students and illustrated his remarks with lantern slides. Dr. Weisse's presentation was in discussion of Dr. L. C. Borland's paper, and was given at this time because the current for the lantern had been arranged for at this hour only.

The association adjourned until 2 p. m.

AFTERNOON SESSION.

The society was called to order by the president at 2:30 p. m.

The first order of business was the discussion of Dr. Price's paper. The discussion was opened by Drs. L. E. Custer and H. L. Banzhaf, and continued by Drs. T. W. Brophy and F. D. Weisse.

On motion further discussion of this paper was postponed until such time as the Executive Board might direct.

The next paper was read by Dr. L. C. Borland, of Chicago, on "Teaching General Anatomy to Dental Students."

The discussion was opened by Drs. F. D. Weisse and W. C. Barrett, and continued by Drs. A. O. Hunt and W. H. Whitslar, and closed by Dr. Borland.

Upon motion Dr. Borland was tendered a vote of thanks for his excellent paper.

Dr. Black's paper was made a special order for 10 a. m. Wednesday.

EVENING SESSION.

The business of the evening was the banquet which was begun at 7:30, the president, Dr. H. J. Goslee, acting as toastmaster. When the gastronomic portion of the banquet had come to a close the president called the assemblage to order, and with a few well-chosen words introduced Dr. G. V. Black, who responded to the toast, "Past, Present and Future of the Institute of Dental Pedagogics."

Dr. N. S. Hoff, of Ann Arbor, responded to "Preliminary Training."

Dr. S. H. Guilford, of Philadelphia, to "What Shall the Harvest Be?"

Dr. A. W. Thornton, of Toronto, to "Our Canadian Brethren."

Dr. W. C. Barrett, of Buffalo, to "The International Aspect of Dentistry."

Dr. F. D. Weisse, of New York, followed with a few remarks which were well received.

Dr. T. W. Brophy, of Chicago, responded to the toast, "Professional Schools Abroad."

Dr. A. O. Hunt, of Omaha, to "Teaching Methods of the Future."

Dr. B. J. Cigrand, of Chicago, to "Our Guests."

The motion made by Dr. Dickinson that the three original organizers of the association, Drs. G. V. Black, D. M. Cattell and T. E. Weeks, be made life members of the Institute of Dental Pedagogics, was carried unanimously by a rising vote, after which the meeting adjourned until Wednesday at 10 o'clock.

THIRD DAY.

MORNING SESSION.

The association was called to order by the president at 10 o'clock.

The minutes of the two preceding meetings were read and approved.

The Executive Board, through Dr. Willmott, reported that the treasurer's books had been audited and found correct. The board also announced that the Committee on New Appliances would report at 12 o'clock, and election of officers would be at 12:30.

Dr. Geo. V. Black then read his paper on "Teaching Applied Physics."

The discussion was opened by Drs. G. W. Wilson and J. P. Buckley, and closed by Dr. Black.

Dr. J. D. Patterson reported for the Committee on New Teaching Appliances, as follows:

"The first appliance we have to present to you is a method for the introduction of work in porcelain. It consists of a set gotten

up for that purpose by Mr. Robert Brewster, of Chicago. We find this a very excellent idea because of the difficulty which we have always met with in getting students started in porcelain work, and this is an admirable way for introducing this work. We have before us the following letter from Mr. Brewster:"

BREWSTER'S INLAY TECHNIC SYSTEM.

This system is devised to aid the teacher in giving instruction in inlay work, and to enable the student to acquire certain manual dexterity in handling porcelain before reaching his senior year. It has for its object—

First. The manufacture of a complete tooth in porcelain.

Second. The formation of cavities in such tooth.

Third. The baking of the tooth.

Fourth. The burnishing of a matrix into the cavity or cavities thus formed.

Fifth. The building up of an inlay in such matrix and baking same.

Sixth. The setting of the inlay into the tooth with cement.

In the first stage he would learn to mix porcelain and mold a tooth—at first in one color; later he would learn to shade the tooth by using two or more colors of porcelain.

In the second stage he would trim the tooth, removing any burr, etc., and if so instructed by his teacher, alter the form of the tooth by adding to or taking from, in this way acquiring skill in carving and the treatment of porcelain generally; and as the material may be used over and over again, no expense on account of waste is incurred.

He would then cut the cavity on lines laid down and described either on blackboard or shown by plaster models, proceeding from simple to compound cavities as he became more expert with the work.

In the third stage he would learn the baking of porcelain, first in baking the whole tooth, and later the inlay of smaller bulk.

In the fourth stage he would learn how to burnish a platina matrix into the cavity. He might also at this stage be taught the method of cement impression and swaging the matrix, thus applying both systems in the one cavity.

In the fifth stage the building up of the inlay with body by stages and baking, then returning to the cavity for burnishing if desired, thus learning in a practical way, and where observation may be accurately made, the actual amount of shrinkage or warpage of the matrix (if any), which takes place in baking, when the body is properly applied.

In the sixth stage the setting of the inlay with cement would be studied, first as to the space actually occupied by cement; second, the effect of different colored cements upon inlays of the same color. For this second purpose, ordinary color paints (which will wash out) might be used of different shades, and when dry, the inlays placed in position without cement, and the color effect tested. This procedure opens up a wide field for investigation, involving, as it does, the "shadow problem" so called.

And finally the tooth or teeth made by the student with the accepted cavities and inlays could be retained by the college for its technic exhibition. The mold, etc., purchased by the student, he would, doubtless, be glad of later, to utilize in making teeth with differently shaped cavities to explain to his patients such points in the work as he might think desirable.

REQUISITES.

1 brass mold in two parts.
1 metal tooth for producing the lingual surface of the tooth.
1 mixing saucer.
1 spatula for mixing.
1 carving tool.
1 bottle of porcelain.
1 packet ground silica.
1 baked clay tray, in card box.

Although this little set of instruments is quite primitive, yet it is sufficient to get the student started in porcelain work. The price of the set is $1.25. Your committee takes great pleasure in recommending this aid to teaching.

At our last meeting we had shown us molds of teeth placed in a vulcanized base which were very much admired. The teeth were perfect in shape and the roots were exposed, showing very good specimens. Now Dr. Arthur has reproduced the whole thing

in celluloid, affording a splendid apparatus upon which to do all kinds of work, such as the shaping of cavities, etc. The price of the appliance is $2. Your committee also recommend this apparatus for use in teaching in dental schools.

On motion Mr. Brewster was given the privilege of the floor for five minutes.

Mr. Robert Brewster:

It occurred to me that a set such as this might be useful because of the difficulties which beginners usually experience in the manipulation of porcelain. You will notice that the teeth in this set are of considerable bulk, which facilitates their handling by the student. Cavities can be cut in them in any direction and in any part of the tooth. Any kind of operative work can be done on these teeth and the student can learn something in a tangible way without any material cost. Besides it will teach the student how to build up porcelain and how to bake it. The student can learn to shape the porcelain into any kind of tooth desired by the teacher and do such other work as may be necessary. I prepared this set in order to submit it to you for your consideration.

Dr. Arthur being given the privilege of the floor, spoke as follows:

When I first prepared this model I had in mind using it for operative technique. We all know that while the rubber forms serve a good purpose, yet they do not give the highest conception to the student, and in teaching we have to hold up a high conception as we are very apt to give wrong impressions even when using a diagram. Students will follow an irregularity of that kind much more readily than they will any correct ideas we may give them. The old forms are exceedingly crude, in fact the only thing that can be done with them is to carve out teeth and get an outline of the tooth. I think that I have in this form something that is nearly perfect. In my original carving of the teeth I endeavored to make a composite tooth, something more perfect than we find in the mouth. The teeth in the mouth are rarely perfect; they are either deformed, or they have a cavity or an abrasion of the incisal edge. In operative technics they cannot operate on the teeth because they

are too brittle. Here they have a tooth with a perfect contour. They can prepare a perfect cavity and put in a filling as it should be. It gives them something of which they can have a high conception, something ideal. The form is also very valuable to me in teaching anatomy. I have given this apparatus the name of "typodont." Students can also make their carvings from these teeth and they have a high type of tooth.

Again this is exceedingly valuable to me in practice. You can show your patients just what you mean and much better than you can describe it.

The apparatus is an incentive to the student to produce something better than he usually does because he has here all the exact details of a tooth. I do not expect this to cover the whole field; only the technique work.

These appliances were discussed and favorably commented upon by Drs. Goslee and Cigrand.

At this juncture the discussion on Dr. Price's paper was continued by Dr. Logan and closed by Dr. Price.

On motion of Dr. Stubblefield the society extended a vote of thanks to Dr. Black for his very able paper.

The next business in order was the election of officers for the ensuing year. An informal ballot was first taken, and on motion the following were declared elected for the various offices as named:

President—J. D. Patterson, Kansas City.

Vice-President—H. B. Tileston, Louisville, Ky.

Secretary and Treasurer—W. Earl Willmott, Toronto, Can.

Member of Executive Board (3-year term)—R. H. Nones, Philadelphia, Pa.

On motion of Dr. Barrett, Mr. Treat, the representative of the Buffalo Merchants Exchange, was given the privilege of the floor. Mr. Treat invited the institute, in a few well-chosen words, to hold their next meeting in Buffalo. He also presented a written invitation from the mayor of Buffalo. Drs. Barrett and Sherwood warmly seconded the invitation. The invitation was referred to the Executive Board.

Adjourned until 3 p. m.

AFTERNOON SESSION.

The president called the meeting to order at 3 p. m.

The Symposium on the Management of Teaching by Demonstrators in the infirmary was opened by Dr. S. H. Guilford, of Philadelphia. Papers on this subject were sent in by the following: Drs. J. B. Willmott, Toronto, Can.; Dr. J. J. Sarrazin, New Orleans, La. The symposium was closed with a paper by Dr. W. P. Dickinson, of Minneapolis, Minn. The general discussion was participated in by Drs. A. O. Hunt, J. Q. Byram, C. N. Johnson, G. W. Dittmar, H. L. Ambler, G. V. Black, H. A. Smith, N. S. Hoff, H. L. Banzhaf, F. H. Berry, W. E. Grant, S. H. Guilford, J. D. Patterson.

On motion the subject was passed.

The master of exhibits, Dr. Cattell, presented his report, which met with much approval.

REPORT OF MASTER OF EXHIBITS.

EXHIBIT OF TEACHING MODELS, CHARTS, ETC.

Pittsburg Dental College—Vulcanite Typodont, Operative Models.
Western Reserve University, Dental Dept.—Prosthetic Models.
Milwaukee Medical College, Dental Dept.—Prosthetic Models.
Louisville College of Dentistry—Operative Models, Anatomical Charts.
Philadelphia Dental College—Orthodontia Models.
New York College of Dentistry—Prosthetic Models.
Indiana Dental College—Prosthetic Models (crown and bridge).
University of Buffalo, Dental Dept.—Prosthetic Models and Charts, Cleft Palate Models.
Northwestern University Dental School—Prosthetic Charts.
Chicago College of Dental Surgery—Operative Models, Prosthetic Models.
School of Dentistry, University of Illinois—Prosthetic Charts (crown and bridge).
T. E. Weeks, papier mache models for all departments.

EXHIBIT OF STUDENTS' CLASS WORK.

University of Michigan, Dental Dept.—Operative, Prosthetic.
University of Buffalo, Dental Dept.—Prosthetic, Bacteriology.
Milwaukee Medical College, Dental Dept.—Operative, Prosthetic.
Louisville College of Dentistry—Operative, Prosthetic, Orthodontia.
Chicago College of Dental Surgery—Operative, Prosthetic, Orthodontia, Cleft Palate.
Indiana Dental College—Operative, Prosthetic.
Northwestern University Dental School—Operative, Prosthetic.
Ohio College of Dental Surgery—Operative, Prosthetic, Orthodontia, Cleft Palate.
School of Dentistry, University of Illinois—Operative, Prosthetic, Orthodontia.

The exhibit department this year excelled greatly in the character of its individual pieces. Much more system was shown in the arrangement of the class work done by students. U. of M. still holds the palm for conciseness and systematic order of arrangement. The Chicago College of Dental Surgery had the largest showing of class work.

Nine schools showed class exhibits and eleven schools presented "Methods of Teaching" for study. This department of exhibits should be encouraged. Each school should know what the others are doing in models, charts, etc.

Respectfully submitted,

D. M. Cattell.

Upon motion this report was received and ordered printed in the proceedings.

Dr. Black reported for the Committee on Curriculum and presented two curricula for the prospective four-year course.

REPORT OF COMMITTEE ON CURRICULUM.

Mr. President and Gentlemen:

Your Committee on Curriculum finds it very difficult to make a report that is satisfactory to the committee itself; consequently

we have grave doubts of being able in any way to satisfy the association. Indeed, it is our opinion, after a careful study of the subject and a somewhat careful canvass of the opinions of teachers, that it would be unadvisable at the present time to undertake to report a fixed curriculum for the four-year course and recommend it as a curriculum to be adhered to strictly by the schools belonging to this association.

The fact is that during the next year the curriculum for the incoming students need not be materially changed from what it is this year, and possibly for the second year of students who come in next year but little change will be required. This being the case, it would seem quite unnecessary that the curriculum for the four-year course be reported at the present time.

But there is another feature of the case that is so important that it cannot be put aside, and that is the demand that each of the schools publish in their next announcement a curriculum for the four-year course. This demand comes from the fact that students will ask to know what they are going to do in that fourth year that has been added, and a curriculum must be offered them, and also a curriculum that will satisfy. This makes it a necessity that something be done by each school in its next announcement regarding the four-year course. It is not necessary, however, that this curriculum be absolutely followed, for it may be changed each year up to the time the fourth year course is put in action. We have no doubt that experiences gained from the study of the subject which will be had between now and that time will make such changes necessary. This does not prevent us from announcing a course, however, for that fourth year that will satisfy students, and also that will represent practically the facts as we intend them. With this understanding, your committee would report two curriculums, differing somewhat as to the number of subjects introduced, with the view of giving a range of choice, perhaps neither to be pursued rigidly, but that each school in making up its individual curriculum may be guided somewhat by these in the placing of their subjects, taking some, leaving others.

The question of optional courses has been discussed considerably, and it may be well to introduce some optional courses in the curriculum. The objection to optional courses is that it is liable

to create classes, each requiring a teacher, and thus multiplying the labor of teaching and the expense of teaching to a degree that would be difficult to supply.

Your committee would recommend to each school to make a substantial addition, either to the subjects taught at present or a substantial addition to the number of hours devoted to the subjects now taught; that each year should have its particular curriculum of studies, and that no year be devoted exclusively to what is called "practical dentistry." The fourth year should have from two to three hours of didactic or laboratory work each day. It is believed by your committee that students will do better in their clinical work, both prosthetic and operative, if this time is carefully devoted to teaching along some of the lines that will interest the student in the work he is following in the clinical room. This should have a bearing either directly or collaterally upon that work. More might be introduced in the fourth year that is more strictly educational in its qualities and character than has been done in our three years' course, and it seems to your committee desirable that this be done.

(Signed), G. V. Black,
N. S. Hoff,
W. H. Whitslar.

SUGGESTIONS FOR SCHEDULE FOR FOUR-YEAR DENTAL COURSE.

FIRST YEAR.

Anatomy—(*a*) Osteology. (*b*) Dissecting half of the median half of the human body. (*c*) Recitations.

Physiology—(*a*) Cellular physiology. (*b*) Digestion and nutrition—Involuntary muscular system. (*c*) Glandular system. (*d*) Lymphatic system. (*e*) Vascular system, the blood and circulation. (*f*) Voluntary muscular system.

Histology—(*a*) Unicellular algae, multicellular algae, unicellular animals. (*b*) Elementary tissues; epithelium, connective

tissue, fatty tissue. (*c*) Organs; alimentary tract and glands. (*d*) Lymphatics. (*e*) The blood, arteries, veins, etc. (*f*) Voluntary muscles and heart.

CHEMISTRY—(*a*). Inorganic chemistry and chemical physics. (*b*) Analysis of unknown compounds. (*c*) Simpler forms of quantitative analysis.

ANATOMY—Of the human teeth.

OPERATIVE TECHNICS.

PROSTHETIC TECHNICS.

SECOND YEAR.

ANATOMY—(*a*) Dissection of one-half of the median half of the human body. (*b*) Recitations.

PHYSIOLOGY—(*a*) Function of nerves, spinal cord, brain, etc. (*b*) The sympathetic system. (*c*) The senses. Reproduction.

HISTOLOGY—(*a*) Nerves, spinal cord, brain, etc. (*b*) Organs of sense and reproduction. (*c*) Section making of the hard and mixed tissues. (*d*) Bone and periosteum. (*e*) Enamel, cement, dentine. Special studies of the enamel with reference to the formation of walls and margins of cavities. (*f*) Peridental membranes and bony supports of the teeth, gingivae, gums and mucous membranes of the mouth.

COMPARATIVE DENTAL ANATOMY.

EMBRYOLOGY.

CHEMISTRY—(*a*) Study of the metals, refining and assaying, problems in applied chemistry of the metals, alloys and practical alloy making, solders and the chemistry of soldering, care of and the cleaning of mixed scrap, recovery of gold, platinum, silver, etc., from unknown mixtures. (*b*) Organic chemistry.

OPERATIVE DENTISTRY—(*a*) Technical procedures in operative dentistry. Lectures. (*b*) Clinical practice.

PROSTHETIC DENTISTRY—(*a*) Prosthetic technics. (*b*) Clinical practice and lectures.

THIRD YEAR.

MATERIA MEDICA—Lectures.

GENERAL PATHOLOGY—Lectures and laboratory.

ORAL SURGERY—Surgical anatomy, surgical operations on the cadaver.

SPECIAL PATHOLOGY AND THERAPEUTICS—Lectures. Practice in treatment cases.

REVIEW OF TECHNICAL PROCEDURES in operative dentistry. Quiz and recitations.

PATHOLOGY OF THE HARD tissues of the teeth.

OPERATIVE DENTISTRY—Lectures. Clinical practice.

BACTERIOLOGY—Lectures and laboratory.

PROSTHETIC DENTISTRY—Technics. Lectures. Clinical practice.

FOURTH YEAR.

OPERATIVE CLINICAL PRACTICE—Lectures. Management of cases in practice.

PROSTHETIC PRACTICE—Lectures. Management of cases in practice.

PHYSICAL DIAGNOSIS—Lectures and laboratory.

ORAL SURGERY—Lectures. Clinics. Care of surgical cases.

APPLIED PHYSICS—Some lectures, but principally laboratory work.

ORTHODONTIA—Lectures and practice. Care of orthodontia cases.

DENTAL LITERATURE—Methods of post-graduate study.

ETHICS, JURISPRUDENCE, business forms, business management of practice, record keeping and dental bookkeeping.

TENTATIVE CURRICULUM.

FIRST YEAR.

CHEMISTRY—(*a*) General Inorganic. (*b*) Qualitative. (*c*) Metallurgy.

ANATOMY—(*a*) Osteology. (*b*) General Description. (*c*) Dissection.

TECHNICS—(*a*) Prosthetic Technics. (*b*) Modeling, carving and drawing.

SECOND YEAR.

CHEMISTRY—Organic Compounds.

ANATOMY—(*a*) Embryology. (*b*) Histology, lectures and laboratory. (*c*) Comparative dental.

PHYSIOLOGY—(*a*) Lectures and optional laboratory course in General Physiology. (*b*) Physiological chemistry (optional) lectures and laboratory.

BACTERIOLOGY—(*a*) Lectures. (*b*) Laboratory.

TECHNICS—(*a*) Crown and Bridge Work. (*b*) Operative Technics.

THIRD YEAR.

OPERATIVE DENTISTRY—(*a*) Lectures. (*b*) Clinic.

PROSTHETIC DENTISTRY—(*a*) Lectures. (*b*) Clinic.

DENTAL MEDICINE—(*a*) Materia Medica. (*b*) Pathology. (*c*) Therapeutics.

ORTHODONTIA—(*a*) Lectures. (*b*) Clinic.

FOURTH YEAR.

OPERATIVE DENTISTRY—(*a*) Advanced work in Laboratory and clinical research. (*b*) Therapeutic Researches.

PROSTHETIC DENTISTRY—(*a*) Cleft palate work. (*b*) Porcelain, inlay, crown, bridge and plate work. (*c*) Orthodontia clinics and research.

ORAL SURGERY—(*a*) Physical Diagnosis. (*b*) Pathology. (*c*) Anaesthetics. (*d*) Principles of Practice. (*e*) Therapeutics.

PHYSICS—(*a*) Lecture course in General Physics. (*b*) Laboratory course of Applied Physics. (*c*) Electro Therapeutics.

PRINCIPLES OF PRACTICE—(*a*) History and Literature. (*b*) Ethical Principles and jurisprudence. (*c*) Business forms.

On motion Dr. A. O. Hunt, the secretary was instructed to have copies printed of this report and sent to the various schools having membership in this association at the earliest possible date.

At the suggestion of Dr. Willmott the secretary was authorized to send all copies of past proceedings to Dr. N. S. Hoff, who stated that he had files in his possession and would supply copies to those applying for them.

At this juncture Dr. Ambler inquired whether the committee on nomenclature of the National Association had adopted any name in preference to another for the dental clinic room. Whether this should be known as the infirmary, the dental hospital or the operatory.

Dr. Brophy moved that it be the sense of this body that the term Dental Infirmary be employed to designate the place where the students fill teeth and do other clinical dental work. The motion was carried.

Dr. Stubblefield moved that a vote of thanks be extended to the profession of Chicago for the excellent way in which they entertained the visiting dentists.

Motion carried.

Dr. Hoff moved that a vote of thanks be extended to the proprietors of the hotel for the many courtesies shown the association.

Carried unanimously.

Dr. Brophy then presented the newly elected officers, who were duly installed.

The newly elected officers expressed their appreciation of the honor conferred upon them. Dr. Willmott particularly thanked Dr. Goslee for the invaluable assistance which he had given him in the carrying out of the work of the Executive Board.

On motion of Dr. Smith the retiring officers were given a rising vote of thanks for their efficient work.

After the reading of the minutes of this and the preceding session, the institute adjourned sine die at 5:20 p. m.

PRESIDENT'S ADDRESS.

By HART J. GOSLEE, D. D. S., CHICAGO, ILL.

An earnest and just appreciation of the duty devolving upon me, as your presiding officer, of presenting an address at this time, causes me to assume the task with a modest degree of temerity.

Being keenly mindful of the purpose and character of this gathering, I fully realize that I am to address the contingent of the dental profession upon which rests much of the responsibility for our professional advancement through the institution and prosecution of means for raising and supporting its more progressive educational methods; and those to whom, I believe, the profession must now look for the establishment and maintenance of wise and correct fundamental, basic principles of education.

It is this realization, combined with the knowledge that I am expected to follow the custom of my official predecessors in naming and intelligently treating the subjects which most pressingly interest us, and demand our consideration, that makes a task and a pleasant duty appear to me to be somewhat analogous.

My conception of this responsibility so completely overwhelms me that should I be able to even approach a just and rightful performance of the duty I shall certainly outdo my most sanguine expectations.

We meet to-day in a convention which is made auspicious by marking the tenth milestone in our history—our tenth anniversary. While we have but to look backward over our vigorous record, and upon the work we have accomplished, to prove the efficacy and usefulness of our organization, such a retrospective view of that which has been already performed, and of the benefits which have accrued therefrom, only enables us to more clearly grasp, and to more fully appreciate, the fact that at the end of the first decade even a greater and broader field for bettering the work of dental education now lies before us.

It has been the good fortune of this body to enjoy a marvelously rapid growth, and to assume a sphere of usefulness beyond con-

troversy, but the premises which we now occupy by virtue of predestination, perhaps, augmented by health and vigor and energy, should not allow us to become unmindful of the primitive efforts which have made it possible to attain to the achievement of results which have in turn aided so materially in the progress of dental education. These efforts, I believe, warrant me upon this occasion in indulging in a brief reference to our history and progress.

Organized for the purpose of fostering and advancing the methods of teaching the technique pertaining to the art and mechanics of dentistry in our schools, a line of work was inaugurated which was new, which was needful, and which awaited and offered great opportunities for development.

From a small coterie dominated by enthusiasm in their special field of work, and imbued with the belief that ways and means by which an interchange of ideas, and a dissemination of thoughts along the line of the teaching of that class of work which was of a purely technical nature should be permanently established, and would be productive of much general good, we have grown until we now encompass a broader field, and one more scientific and strictly pedagogic in character.

When an organization is born it is not always possible to prophesy the scope of its life's work. In the midst of a primeval forest we have hewn, cleared, builded, added to and embellished until there now stands a structural work of sturdy proportions, and of modern scientific architecture.

Whatever the original thoughts and the primary objects might have been, the tendencies of this organization from the very first have been to enlarge the range of subjects to be considered. While this disposition was for a time questionable in the minds of some, it ultimately became warrantable, and apparently necessary, for the reason that no other body assumed to devote the proper attention to this particular line of work, or seemed so well adapted to such purposes. As a result, our present status is but the natural outgrowth of necessity, and any institution must be a needful acquisition to its immediate community to succeed and advance.

While it is notably true that advancement along the lines of teaching is being constantly made in every department of educa-

tional work, this advancement is perhaps more particularly evidenced in dentistry than in any of the arts and sciences; unless it be the science of pedagogy itself, which is still in its infancy.

That the work and influence of this Institute have done much to inspire and promote this degree of development and progress can scarcely be doubted.

During our past meetings we, as teachers, have been getting closer and closer together. We meet as men engaged in the same lines of work. Our interests are mutual. We have no legislation or politics to engross or divert our attention. We know how the various teachers in different schools present and teach their respective subjects, and we are more or less familiar with the advanced ideas of the most successful teachers.

The natural result of such coordination is that a more advanced, progressive and uniform course of instruction is now given in all of the fifty-two recognized dental colleges in the United States and Canada, in view of which, since no other body has been similarly engaged, or could devote their concentrated efforts to such work, it seems quite improbable for this Institute to have infringed upon the territory, or usurped the rights of other organizations.

The development of system in the methods of teaching during the past decade, and the constant improvement which is being made along these lines, all of which are evidenced by the amount of instruction now being given in a course of three terms, as compared with only a few years ago, must be regarded as an eloquent tribute to the work of this body.

When we pause and reflect upon the vast amount of instruction which the well-regulated dental school now succeeds in giving during the prescribed course, and the part which this organization has played in making it possible, and in further developing and promoting it, both the degree of correctness in our principles and purposes, and the scope of our possibilities and usefulness are manifest, in view of which I submit, without fear of just criticism, that the whole range of dental teaching is not too broad to be considered by this body, or to be benefited by its deliberations.

The subject of dental education in the broadest sense, in my opinion, is now by right of privilege and competency the work of

this institute. With such interpretation of our function, it would seemingly be quite inadvisable, if not, indeed, impossible, to draw any line of distinction between the teaching of all correlative subjects which must be included in the dental curriculum, and which result in the further development, progress and broadening of our educational requirements.

Because of the indomitable activity pervading the ranks of this body, and the nature of our contributions, which have encompassed a range extending from the purely practical to the highly scientific, thus enabling us to become rich in experience, I believe that in so far as *the prerequisites of teaching* are concerned, this is now the one organization in America perhaps best qualified and most competent to consider *all* questions and problems pertaining to the advancement of dental education, and that an infinite amount of general good must necessarily result from such consideration.

While we have no legislative power—and I trust that we shall never assume to have, for much of the good work which has been accomplished may be attributed directly to this fact—I am of the opinion that it is also within our special province to include and deliberate upon the subject of curriculum.

This is said advisedly, because I entertain the belief that nothing has more to do with modern dental education than a well regulated curriculum, and I am also constrained to affirm that much of the advancement which has resulted, directly or indirectly, from the efforts of this body, or which shall so result in the future, may be attributed to the systematizing and unifying of the curriculum, as well as to the development and elaboration of teaching methods.

However much progress has been made in recent years in the systematic presentation of principles, the teaching of dentistry has not yet quite crystallized into permanent form, and the work incident to such crystallization, and to properly placing these principles in the curriculum, may yet require some time, and is just now of infinite and paramount importance.

In all branches of general scholastic training, there is a universal lack of unity, and while a more or less uniform dental curriculum would doubtless be eminently desirable, the individual conditions and environments are such that any effort to establish the same

would probably prove futile. It may not even be possible, or to the best interests of the individual schools, yet, at the present time, there is such a wide diversity that the condition is almost deplorable, and there can be no doubt but that a far greater degree of uniformity would be of inestimable advantage to all colleges, and to the progress of dental education.

As to what should be the possible scope of an adequate and suitable curriculum, I could make no better or broader recommendation on this, the very eve of the adoption of the four-year course, than to quote from the splendid address of my immediate predecessor, Dr. George E. Hunt: "The dental college curriculum should be such that a degree of Doctor of Dental Surgery will carry with it a breadth of knowledge, and a wealth of attainment, that would put its possessor on a plane with those who have taken the degree of Doctor of Medicine."

That this is a laudable and reasonably logical recommendation must be admitted, and that it is without doubt the desire and effort of the representative colleges and teachers to so qualify their graduates is evidenced by the increased course of preparation and study now required by all reputable dental schools.

In view of the marked development and advancement in this connection, there is seemingly but one essential prerequisite to such a sequence, and this is that the preliminary requirements for admission into all dental schools must first be placed upon a more or less uniform standard similar to that governing admission into the leading medical schools. In this connection, I believe that an educational qualification for admission into our schools should be equivalent to that for the admission of students into all high-class institutions of professional learning.

This, however, is the work of our legislative bodies, and is now being more or less diligently prosecuted, to the end that when this shall have reached an equivalent standard, it is safe to prophesy that graduates of dentistry will be received and recognized on the same plane with those from the school of medicine. Moreover, they will be sufficiently well qualified to justly merit and sustain such recognition.

Indeed, even at the present time, with much work, and an ever-growing opportunity for improvement still before us, as an evidence

of our progress and as a result of the increased requirements incident to pursuing the study of dentistry, of the development and systematizing of our methods of teaching, and of the broadening of our curriculum to its present scope, I feel sufficiently well informed by observation and comparison to agree with the statement recently made by Dr. Truman W. Brophy, in his address to the Commission on Education, International Dental Federation, at Stockholm, Sweden, to the effect, "that the average dental student in the representative dental colleges of America today has to cover a broader field of preparatory work than the average medical student under similar environments, and that the average graduate of such a dental college is, on the whole, better qualified to undertake the responsibilities incumbent upon the practice of his profession, than is the average graduate of such a medical college."

This statement may possibly seem somewhat dogmatic, but if we contemplate the full preparatory course of the dental student, and that the most successful and proficient practitioners are those who early adopt, and confine their efforts to, a particular line of work or specialty; that the study of dentistry is infinitely the study of a specialty, while that of medicine is of necessity more general, I believe that a surprising degree of truthfulness and correctness will be revealed. Because of the high degree of manipulative skill, and of the knowledge of the intricacies and technology of art and mechanics demanded by the specialty of dentistry, I regard it as entitled to rank next in importance to the specialty of *general surgery*, which is the manipulative and mechanical department of medicine.

The efforts of this organization stand out conspicuously among those of others in the development of conditions which thus place the specialty of dentistry on a higher plane, and tincture such utterances with reason and logic. Dentistry has assumed the dignity of a profession, and the practitioner that of a professional man, simply because of the tendency toward higher educational requirements. Even in the most humble community, a professional man is accorded a certain degree of respect, not because of his personality, or of his efforts to exemplify the modern Beau Brummel, but solely for the reason that the title carries with it a certain assurance of the pursuit

of learning and the acquirement of knowledge which is somewhat beyond the strata of commercial pursuits.

But, as a body, we can yet do more. If we are to contend for regard as embracing relationship and equality with higher medical science, we must further extend our curriculum to include all necessary and useful correlative subjects.

Incident to the installation of the four-year course, I regard nothing of such momentous importance as the consideration of the various changes in, and additions to, the curriculum, which must necessarily be made to broaden the course and cover the extended time to the very best advantage. And, while not unmindful of the preceding excellent recommendations in this connection, and of the appointment of a special committee which is expected to report at this meeting, I am, nevertheless, constrained to briefly indulge in a few recommendations on my own account.

Among other advanced ideas, our profession has come to regard with interest the importance of the subject of physical diagnosis. Some colleges have already added this line of study to their curriculum, and others are putting forth some effort to establish it in theirs.

This effort is most heartily commended. I believe that the dentist's province of labor demands a knowledge of the varied physical conditions constantly met in practice, notwithstanding the somewhat cynical opinions occasionally expressed by more or less narrow-minded members of the medical profession to the contrary.

It has been intimated that the only occasion for knowledge in physical diagnosis on the part of the practitioner of dentistry is in connection with anesthesia, and while we might concede that this connection is the most important one, yet I deny most emphatically that it constitutes the entire scope of desirability and requirement for knowledge of the physical conditions presenting.

Knowing that there is a relationship existing between the dental organs and the general physical condition, even though this relationship is largely of an indirect nature, should we ignore the study of the manifestations of these conditions?

I believe this study should be pursued with as much interest and energy by the student of dentistry as by the student of medicine. I entertain this opinion, not only because of the importance to the den-

tist of knowledge of this science, but because I cannot countenance restriction of dissemination of knowledge to the dental student which will even indirectly aid him in better fulfilling the purposes of his calling, or which shall detract from his standing before the community as an equal in scientific aspirations and attainments of the student of medicine, or of any other science or profession.

A dental course in this subject to be sufficiently broad should embrace didactic instruction in the normal location of the thoracic and abdominal organs; the location of pathological conditions, and the diseases which may cause them; the effects produced by these pathological conditions upon the general system, and how such may indirectly cause diseases of the teeth and mouth; the care of the teeth during, and precautions incident to pregnancy; the care of the teeth and mouth in syphilitic conditions; the deformities of the teeth and mouth which may result from naso-pharyngeal conditions; the indications for general anesthesia, and the precautions and dangers incident to its use.

This didactic work should then be supplemented by a practical course, consisting in the examination of the normal and abnormal chest; the diagnosis of pathological conditions of same; and the examination of the heart, lungs, kidneys and liver, together with the effects produced upon these organs by the administration of ether, chloroform, nitrous-oxide and cocaine, or therapeutic agents of any nature which might have a pathological influence upon them, bearing upon anesthetic administration. All of these considerations from a general point of view are important, and from a dental viewpoint are essential to a broad education.

I also heartily endorse the previous recommendations for a thorough and well-rounded course, from a dental view-point, in biology, bacteriology and applied physics, the importance of each of which demands for them a more or less conspicuous place in the curriculum, as a means of further broadening the desired preparation and qualification of the student.

A course in pathological laboratory work would also be a valuable addition. The student would thus be enabled to examine into the varied pathological conditions constantly met in the infirmary, and be the better prepared to successfully treat such conditions be-

cause of the possession of knowledge of means for facilitating the accuracy of scientific diagnosis.

A practical laboratory course in pharmacy, materia medica and therapeutics is also recommended, and without doubt would prove of inestimable value.

I would suggest that such a course be divided into separate classification, as designated, and that each should embrace the following:

Pharmacy. First: Metrology. Weights and measures; the metric system; specific gravity, and use of apparatus for determining same of both solids and liquids; specific volume; parts by weight; percentage volume and weight; percentage solutions.

While this is, of course, almost exclusively *physics,* its direct bearing upon the completeness of such a course warrants its place in this classification, and a more advanced didactic and laboratory course in applied physics, to include fundamental instruction in the possibilities of electricity, photography, radiography, etc., would also be useful and eminently desirable, and without which the curriculum of any dental school will be incomplete.

Second: *Pharmaceutical Preparations.* All such preparations need not, of course, be considered, the selection being confined only to those *classes* which are, or should be, used in dentistry, e. g.,

a. *Solutions.* Those solutions, under which general class belong such preparations as waters, solution, spirits, syrups, elixirs, glycerites, collodion, etc.

b. *Products by Extraction.* Wines, vinegars, tinctures, fluid extracts, extracts, etc.

c. *Mixtures.* Liniments, etc.

d. *Mixtures of Solids.* Powders, etc.

e. *Preparations for External Use.* Ointments, plasters, etc.

Third: *Prescription Writing.* Under this head should be considered (a) language and abbreviation; (b) the signs and terms; (c) incompatibility, etc.

Fourth: *Compounding.* In this work prescriptions should be written calling for both official and unofficial preparations, such as ointments, powders, plasters, percentage solutions, etc.

Such prescriptions should be *corrected* and *filled,* thus imparting to the student a knowledge of the art of mixing ingredients as well as of prescribing.

Materia Medica. The work of materia medica should consist in the study of *crude drugs,* with an examination of the *characteristic* of the drug as it appears in commerce; the official *title* in Latin and English; the *origin,* whether botanical, animal or mineral; their constituents, properties, dose, and the various pharmaceutical preparations into which they enter.

Therapeutics. This work would best be devoted, perhaps, to demonstrations and experiments upon the lower animals, as such is the only effective means of treating practical toxicology. The action of such poisons as arsenic, morphine, cocaine, strychnine, etc., may be observed, and the antidotes for each, and how they may be best administered, can be considered.

Special attention may be also directed to the application of each drug, so studied, to the various pathological conditions of the human system.

A course in *Laboratory Physiology* would also prove a valuable addition to the dental curriculum, and the following suggestions may serve to illustrate the possibilities and practicability of such a course:

I. Electrical Batteries: Elements, conductors, keys, commutators, rheostat, rheocord, etc., and the teaching of the uses of the various apparatus employed in muscle and nerve stimulation.

II. Muscle-nerve Preparation: Stimulation and records; the laws of construction, work done, etc.

III. Circulation: Frog's foot: The laws of flowing liquids; force-pump; pressure; schemes for artificial circulation; pulse sphygmograph; vagus effect, etc.

IV. Respiratory Measurements: Pressure; lung capacity; laws of gases; respiration of various gases; nerve stimulation of respiratory apparatus, etc.

V. Ferments: Action on carbohydrates, proteids and fats; characteristics of foods; laws of absorption; diffusibility, etc.

VI. Blood: Counting corpuscles, hemoglobin determination: hematocrite; bone marrow; blood clotting, etc.

VII. Physiological action of the more common drugs on tissues in which the local effects on flesh, etc., and the constitutional effects on live animals may be observed.

This course may be made supplementary to the former, and each will be benefited by and advantageous to the other.

Getting down to the more practical subjects (so-called), I also earnestly recommend the addition of a thorough *laboratory course* in *dental metallurgy,* based somewhat along the lines recently suggested by Dr. Hodgen, and deprecate the fact that so little attention is given to this important work by so many schools.

The course must necessarily follow a didactic course, and the first work in the laboratory should be to familiarize the student with the various apparatus, appliances and fluxes used in the fusing and alloying of metals.

This should be then followed by a study of the metals, their characteristics and physical properties, and those should be selected for the first experimental work which best illustrate these general properties; and those properties of malleability, ductility, tenacity, conductivity, specific gravity, fusing point, electro-positive character, etc., should be carefully noted.

The experimental study of the individual metals should be followed by mixing them in the preparation of alloys, and *all of the various alloys used in dentistry should be prepared by the class.* In this work the student becomes acquainted with the properties of alloys by discovery. He notes the influence certain metals have on the alloy, and the difficulty of adding low fusing and easily oxidizable metals to higher fusing ones, which is especially important in making solders and dental amalgam alloys, all of which knowledge is so materially essential to their proper and skillful manipulation.

In view of the rapidly increasing importance of the ceramic art in its application to dentistry, I also most urgently advocate a course in advanced operative technics, to embrace the various phases of porcelain work.

Such a course should consist in the study of the composition and characteristics of porcelain "bodies;" their preparation, coloring, shading, manipulation and fusion, and the preparation of cavities and adaptation of inlays by the various methods. In this connection

I am pleased to endorse and call your attention to a simple method of presenting this subject which has been devised by Mr. Robt. Brewster, of Chicago, and which upon request will be further elucidated during this meeting.

Granting that all of these, and perhaps many other additions of equal importance, must be accommodated and properly arranged in the four-year curriculum, I believe that after the first year shall have adjusted itself, we will wonder how we succeeded as well as we did without them, and in less time.

I also believe that the amount of time spent upon the teaching of all subjects, and their proper place in the curriculum, can and should be settled by this body; and that if any degree of uniformity is to be obtained, our efforts will be productive of much good. In this connection, however, irrespective of individual exigencies or conditions, the arrangement must be made on a "broad, sound and logical basis, and not for the convenience of any school or teacher."

In the arrangement, it must be remembered that we expect and exact much of the student, much that is unnatural and difficult, for many; for but a limited proportion are capable of grasping and comprehending the more scientific elements, and assimilating with them those of the more mechanical and technical order.

The first efforts, then, should be directed toward the development of an interest in the work, a recognition of the requirements, and an appreciation of the possibilities. It has been said that in the development of handicraft of an artistic nature, we must first cultivate the sight, as the eye must see in order that the mind may comprehend, and the mind must comprehend before the fingers can execute.

When this stage of development has been reached by an adequately adapted primary course in manual training, such as has been already recommended, and accepted as invaluable, the student is then prepared to more fully appreciate the advantages of technique, which, of course, has for its basic object the development of familiarity with the fundamental principles, and with the nature and characteristics of the materials employed.

For this reason, if the arrangement be based upon a scientific, progressive system, I am of the opinion that prosthetic technics should begin with and extend through the first year, and that the

only part of operative technics given during this period should be a thorough groundwork in dental anatomy; and the present system of carving is regarded as the best means of impressing the latter subject.

As a further evidence of the logic of this recommendation, I will quote a statement made several years ago by Dr. N. S. Hoff, with which I am in perfect accord: "One of the strongest reasons for making the prosthetic course the primary and fundamental one is because of its being so versatile—some of the operations being so simple and others so intricate that it is admirably adapted to the purpose of developing skill in handicraft." For this reason, the student who has pursued this course first, and has also received instruction in dental anatomy, is thus better qualified to take up operative technics at the beginning of the Sophomore year, which, in my opinion, is where it properly belongs, and should be placed.

In conclusion, gentlemen, permit me to take occasion to express assurances of my deep sense of appreciation of the honor you have conferred upon me, which thus permits me to inflict myself upon you in this humble plea for increased and broader educational and professional requirements, and to thank all of the officers for their loyal support, and you for your attention.

DISCUSSION.

Dr. N. S. Hoff, Ann Arbor, Michigan:

Mr. President, it gives me great pleasure to commend the very admirable and suggestive address to which we have just listened. I am particularly pleased because Dr. Goslee selected as his theme the ever-interesting subject of the curriculum. This selection is especially fortunate in view of the fact that the committee which was to have made a report at this time upon the character of the curriculum for the four-year course is unable to make that report. An opportunity is afforded us to discuss this important matter by taking up the various points considered by our President. As a member of the committee appointed by the National Dental Faculties Association to prepare a four years' curriculum, I prepared one which I thought might at least serve for the purpose of eliciting discussion; but when the committee had its preliminary meeting at Niagara Falls, last summer, it was decided that it was not an op-

portune time to enter into a discussion of that subject. The committee concluded that it would simply hand in a report of the curriculum committee and allow it to be printed in the transactions, to lie over for a year so that the members of the association might have sufficient time to think the matter over.

I have been cherishing the hope that your committee on curriculum would bring this subject up for discussion at this meeting, because I am convinced that in this body we can more deliberately discuss this subject than would be possible in the National Dental Faculties Association. Here we have less of outside interest. I trust we may be allowed to discuss it fully in connection with the President's address. Before another meeting of the National Faculties Association is held the announcement of the four years' course must be published by every dental college in the country, and that announcement should contain a four years' curriculum.

The suggestion made by the President of the desirability of a uniform curriculum for all the schools must appeal to us as a timely one. It declares the object to which we have aspired in the discussions of this body for the last ten years. We have been working toward it, yet we have not been able, either theoretically or practically, to come to any definite conclusion. But our minds are gradually centering toward uniform methods of instruction. This has come to be so not because we wanted it, but because by exchange of ideas each one has been compelled to modify the consideration of his special subject. Each teacher has seen in the methods of another things which he could adopt with benefit.

I do not think that it will ever be possible for us to dogmatize on this subject. We may gradually drift into a practically uniform curriculum because of this interchange of ideas which occurs in these meetings, but there are many difficulties to meet. Every school has its own environments and peculiar features, something which we cannot possibly control as a body, because each school must solve that problem for itself. Hence I do not expect that we will ever arrive at an absolutely uniform course of study for our dental schools.

But we may well let that take care of itself. So long as we continue to come together year after year to discuss subjects I have

not the slightest doubt that our curriculum will in due time be sufficiently uniform for all needed purposes.

The most important question at this time in connection with this subject is the consideration of what shall be done with the added year of instruction which goes into effect this fall. What shall this instruction be? I am not prepared to answer that for anyone else, but I have my own views about it. Through the influence of this association and other instrumentalities, to which I have already referred, we are progressing along the lines of technical development in a way that is entirely satisfactory. That department of our work should be disturbed as little as possible. The first three years should remain practically as they are now. They should contain practically the same subjects, taken up in practically the same order and to the same extent. In this way we will gradually work into the four years' course in the easiest possible way and without disturbing existing conditions, and there will be less occasion for making mistakes. If we attempt to reorganize our whole system of instruction and adopt some ideal scheme based on four years of instruction, tearing to pieces our present curriculum, I fear that the results may be very unsatisfactory. I think that in the first three years of our present curriculum it is possible to develop the technical aspect of the subject sufficiently for all practical purposes. But it seems to me that we should make a more general advance. There is a great deal said about our being a profession, but we are often compared with others to our disadvantage. We are called techniquers and mechanics and we have no broader outlook than any other mechanic in a high grade department. That is, of course, mere talk with which we cannot have any sympathy, because it is not founded on truth. But there is apparently some reason for it because of the fact that the large majority of the members of the dental profession today are men who have not gone much farther than the technical departments. Occasionally you will find a man who branches out into literature or other subjects and makes a name for himself. We have a few specialists, a few scientists, a few Blacks and Millers, who have gone on in advance of their profession, but the rank and file have not advanced very much. It seems to me that the reason in large part has been that we have not in our system of education taken cognizance of the principles that are necessary to develop that sort of

men. The students do not have any opportunity to think for themselves. Their time has been occupied with technique and their minds filled so full of the practical side of their work that they could not take advantage of the opportunities which presented for the development of the scientific side and of a broader culture.

In this fourth year of our course we ought to take up the scientific subjects and study them in such a way as to develop men who are able to initiate for themselves work of a scientific character. Preferably it ought to be in the line of such subjects as pertain to dentistry. How many men are there in the dental profession today who have any fundamental knowledge of the subject of physics? We must confess that we know very little about it. There is hardly a man practicing dentistry in Chicago but who is making more or less use of electricity, but when his machine gets out of order he must send for an electrician. He cannot put in a fuse, nor make other necessary repairs to his engine. He knows little or nothing about the management of that wonderful agent. The whole subject of cataphoresis has gone out of existence because we did not know how to use it. The subject of radiography is also one that is beginning to come into notice, and as dentists we have greater opportunities for developing the practical application of electricity than any other profession. There is hardly a dentist anywhere who is not using electricity in some form or other. Among physicians you will find one here and there using electricity, but they are few when compared with the number of dentists using it. And why should we not know all about it? That is one subject which we might add to our four-year course. There is enough in it to take up the time of the whole year.

Another subject is the introduction into this fourth year of original research work. Is it not possible for us to lay the foundation so broadly that in the future, instead of having only one or two men in the country doing this work, we may have many of them?

In this way our profession will make the advance that is demanded of it in order that it may be recognized as a profession by everybody.

There is, then, no question but that there is an abundance of new material which may be utilized in the fourth year without disturbing the present curriculum in the least.

Dr. S. H. Guilford, Philadelphia, Pa.:

I did not have the pleasure of hearing the whole of the President's address, and therefore what I have to say will be more on what Dr. Hoff has said. I have two thoughts to present. One with reference to the four years' course. He gave it as his opinion that the college course as it exists at the present time should be the course which is followed in the four-year course, and that the fourth year should be devoted largely to practical work. That would be very well were it not for the fact that most of the final examinations come at the close of the fourth year; and also because of the fact that the state board of examiners insist on examining all the students on all the subjects at the close of their college work.

Now, if a student is examined at the end of the fourth year on work that he completed in his third year he will hardly be prepared to stand an examination at the end of his college course. For this reason I do not believe that Dr. Hoff's idea is a practical one.

There is another solution of that question, however, one that struck me rather forcibly. Many of you no doubt know that in the State of New York the medical examining board has arranged that the medical student shall be examined at the end of the second year on the studies pursued during the first and second years, and, if passed, that examination is final so far as those studies are concerned. At the end of the fourth year students are examined on the studies pursued during the third and fourth years. That method is both equitable and just, but unfortunately we have no such procedure in our dental work. That matter was strongly emphasized by Dr. Litch in an editorial appearing in the *Dental Brief*, in which he called attention to this fact, arguing that the Dental Examining Boards of the various states should arrange that when the four years' course begins students will be examined twice during their college career; first at the end of their second year on all work done during the first and second years, and at the end of the fourth year on all work done during the last two years, so that the student will

not be compelled to be examined on subjects on which he naturally has become rusty.

Unless we can make some such arrangement it would not be advisable to stop theoretical studies at the end of the third year or to pass any final examinations at the end of the third year. I hope that this subject will be considered fully by all interested with the view of prevailing upon the Dental Examining Boards to give the dental student two examinations; one at the end of the second year and the other at the end of the fourth.

The second point I wish to refer to is with regard to the matter of physics, teaching physics more fully in the dental schools: I agree thoroughly with Dr. Hoff; I realize how imperfectly the subject has been taught in the past and I also realize the importance of it. Dr. Hoff referred especially to a particular branch of physics, electricity. I do not feel the importance of that so much as I do of others. In my opinion the most important part of physics is dynamics. There we come in contact with things we use every day, such as the laws governing force. How can a man make a plate and have it give proper service unless he knows something about how the force will be exerted to hold it in place in the mouth, and know the force that will give the best use of the plate? I have known many a plate to be a failure because when the mouth is closed the teeth meet in the wrong direction; instead of pressing upward and backward they press upward and forward.

And so it is with everything connected with artificial work that we have to do, not only as to modifications in the forms of the teeth but also in the way in which force is to be applied to different mechanical appliances. If we can get the student to understand the principles governing these things we will have conferred upon him a wonderful benefit. The whole subject is a large one; we are nibbling at it here and there, and I have no doubt that out of this discussion we will derive some good. But we must be careful in considering this matter so that we may approach the subject in its entirety and select from the whole matter such things as we think are of the greatest importance.

Dr. E. T. Darby, Philadelphia, Pa.:

I regret that owing to a belated train I did not hear the first part of the President's address. What I did hear, however, im-

pressed me as being able and comprehensive in character. I have also listened with much pleasure to Dr. Hoff in his discussion. They have both outlined a curriculum which, if it could be carried out, would thoroughly equip the dental student to enter upon the practice of his profession, but I am in doubt about so much being accomplished in the time allotted. Broad culture many-sidedness are beautiful things to contemplate, but I greatly fear the tendency has been and still is to add too many things to our dental curriculum. We are striving to make too much beside practical dentists of our students. The tendency is to demand too much of our students at the expense of the practical work in the operative clinic and the prosthetic laboratory. We have already in our three years' course as much as we could reasonably expect a dental course to furnish. The men who have become great have wrought their greatness since leaving college. It has taken more than four years to make a Black, a Barrett, a Miller or a Brophy. All that the colleges can do is to lay the foundation, and if the student is made of the right material he will complete his education in a scientific direction after he has received his diploma. I may surprise you by the statement, but I have the courage to utter it, that I believe we made better practical dentists twenty years ago than we do today. We did it because there was less demand upon the student's time in acquiring a knowledge of chemistry, anatomy, physiology, histology, bacteriology, osteology, etc., etc. The student of today spends more time in learning these things, good as they are, than he does in the operative clinic and the mechanical laboratory.

We are about adding another year to our course, and I would make a plea for a year of practical work. Few men are competent to practice dentistry when they leave college. They lack the skill which practice alone can give them. It is only by doing over and over again the operations which the dentist is called upon to perform that he becomes skillful. All men are not alike apt in learning. One man will accomplish in three years what another will fail to do in four. Let the work of the fourth year be of such a character that the mediocre man can perfect himself in the point where he is weakest and the man who has mastered the curriculum of the three years can do research work in the fourth. It seems to me that the one important thing for us to do is to make good dentists, and al-

though we may succeed in turning out good chemists, good anatomists, good histologists, good bacteriologists, if we do not turn out good practical dentists we are falling short of our duty as teachers.

I beg of you, then, as one who, like yourselves, is interested in college work, make this fourth year which will soon be added to our course largely a year of practice, and, my word for it, we shall graduate men better qualified to practice dentistry.

DR. WM. C. BARRETT, Buffalo, N. Y.:

I am heartily in accord with what the previous speaker said until he reached a certain point, from which I must diverge. That point has reference to the character of the teaching. Four years is certainly none too much for our elementary training. The idea of contracting and condensing all our instruction into three years is an absurdity, when we take into consideration the extraordinary expansion of the curriculum made necessary by the growth of dentistry during the past decade. We have added science to science, and study to study, until the lecture schedule is so congested that scarce time is left for eating and sleeping on the part of the diligent student. I tell you that we cannot do good work in this way. The great trouble with our schools and teaching today is that we are hurried too much. We can do little more than to "cram" students, and you well know that mental indigestion is the natural result of such a process. You are aware that in all schools it is sometimes the case that at the close of the term a bright student who has done little in the class room during the whole term proceeds to "cram" for the examinations, and he may readily be able in this way to pass them successfully. But he has consumed his mental food so fast that there has not been time for perfect assimilation. He has "bolted" wisdom, as some greedy children do their dinners, to the ruin of the digestive apparatus. This kind of either mental or bodily feeding is the worst possible. Under it we are even now working our students too hard. We are not teaching deliberately, calmly, slowly, effectively, piling fact upon fact only so rapidly as the mind of the student can assimilate each and make it a part of his educational structure. When we attempt to give three lectures in one forenoon, each an hour long, perhaps one on anatomy, another on his-

tology and a third on chemistry, one following the other, they become a confused jumble in the mind of the average student; his apprehension and comprehension are overtaxed; his appetite is clogged; his assimilation is obstructed; the principles inculcated remain an undigested mass, if they find lodgment at all. There is no time for reasoning; we cannot *educate* (educo—to draw out); we can only thrust in that of which little use can be made; there is no opportunity to make practical use of that which is imparted. This I maintain is not to educate. It will not make the best practical men. Under it we shall in time degenerate into intellectual prigs who know all of dentistry save its practice.

The proper method of teaching, the teaching which is successful, is that which is done deliberately; giving time enough for the assimilation of the facts, opportunity thoroughly to comprehend them and then to compare them with other related truths. When the student is driven too hard, forced to the extreme point of endurance, there is no perfect education, and there can be none.

I am quite in accord with the previous speaker when he says that we are loading up our curriculum with sciences and subjects which should be placed in the preliminary course. Is a man to enter on the study of applied science without a knowledge of physics; should he go back and learn his a, b, c after he has started on a course of technical training? No, he must have an elementary schooling which he should receive in his preliminary course, and then we can build on that structure, and rear an edifice that shall endure, that shall be harmonious and symmetrical and perfect in all its parts.

Concerning the fourth year which we are about to assume,—I thoroughly believe in the method pursued in New York in the medical schools, that in certain basal studies the students shall be allowed to take their final examinations at the conclusion of the work in those branches, that their last term may not be crowded too much. Not that I would advocate having our students take their final examinations at the end of the second or third year, except in such basal studies as form the foundation for their real professional work. My idea would be at the end of the second or third year to finish and take the final examination, not only in college but at the hands

of state dental examining boards, in anatomy, chemistry, physiology, materia-medica, embryology and histology, with possibly one or two other studies, so as to relieve the congestion of the curriculum,—the state dental examining boards, where there are such, should admit to final examination under the proper restrictions, for students must take them when the matter is fresh in their minds. Thus they can devote their fourth year to the applications of that which they have previously learned. I do not mean that I would postpone all practical work until the fourth year. The principles should be applied as fast as they are acquired. I would not make the fourth year a post-graduate course, but I would include in it much that can now be only acquired as post-graduate work. I would devote the fourth year to the higher expressions of prosthetic and operative procedure, and I would in addition give thorough instruction in oral surgery, pathology, therapeutics, diagnosis, biology, etc. After such a course we might hope to see graduates grounded in that of which practitioners of the present day talk a great deal, but of which personally they have no comprehension whatever.

The complete course of study, the general curriculum then should include all necessary branches, and should not close until the final fourth year. Hence, simply to devote the whole fourth year to practical work is robbing the preceding classes of that which might with propriety, some of it at least, be given to them, and at the same time it is depriving the senior or fourth year class of very much of scientific information, of that more advanced knowledge which should form a part of the whole curriculum.

We can only arrive at a wise conclusion by a comparison of ideas and thoughts and methods in the consideration of this subject, and I am thoroughly convinced in my own mind that the fourth year must include a fair proportion of didactic as well as practical instruction. Just what the proportion will be depends upon the instructor, because the really competent teacher will certainly adapt his instruction to his classes. He cannot be taught that; the wise teacher must be a wise man; a man who cultivates his mind; to a certain degree an ascetic, a recluse, who denies himself the luxuries of life and devotes himself entirely to intellectual studies; who is competent properly to disseminate knowledge and to discriminate amongst studies and between students. I say he must to a degree

be an austere man, of hermit proclivities. That follows as a matter of course. He cannot avoid seclusion or the mortification of the flesh. If he devotes himself to his extremely rigorous but ill-paid calling, he will have neither time nor money for self-indulgence or even social recreation. He cannot attain to absolute success except through absolute consecration of all he has and all he is to his work. He must find his reward from within, and not by accumulation from without. How many are willing to pay the full price?

Dr. Truman W. Brophy, Chicago:

A university that is complete in all its departments must teach everything. Each one of those departments is supposed to represent some special line of study, or some special branch of knowledge. The essayist has spoken of our work, of our calling, as a specialty in medicine. If we take the university, then, and extract from each of its departments all that is contained in medicine, or take, for instance, the department of medicine; if it enhances dentistry, then dentistry is a specialty in medicine. If we find after careful examination of this special branch of education, medicine, that there is not in it dentistry, or there is not in it that training and work in the laboratory and in the lecture room and in all its departments the teaching essential to make the dentist, then dentistry is not a specialty in medicine. We can take from it only that which is in it, and dentistry is not in it. Diseases of the teeth are more prevalent than any other disease known to mankind, and yet it is a fact that no medical man can deny that the curriculum of the medical school makes no provision, generally speaking, to teach this important branch of medical science.

The physician oftentimes labors against enormous odds in attempting to make a diagnosis of lesions dependent upon diseased teeth for their origin. He gropes in the dark and administers remedies when the disease is due to some local disturbance which he has not been taught to recognize. Consequently dentistry, as we accept the term to include all we teach in our schools of dental learning, is not a specialty of medicine. We might say that it is a specialty in the great science of chemistry with equal propriety. We might say that it is a branch of electricity because we use electricity. Medical men and medical faculties oftentimes labor under a misap-

prehension when they believe that certain subjects taught in medicine exclusively pertain to medicine. I do not wish to wander from the subject more than to say that chemistry is a science in itself; the purest science except mathematics. It has a firmer foundation, and its laws are more fixed than any other science except mathematics, and yet no one has ever claimed that mathematics is a department of medicine.

I enjoyed the President's address very much, and if you will go over it carefully and study it, as one must do, you will find that he has mentioned many subjects that have absolutely no connection with the medical school; in fact, they cannot be taught as a part of medicine.

There is no one living who has a higher appreciation of Professor Darby and his work as a teacher in operative dentistry than I. I understand why he took up the line of argument he did, but I must differ with him in some respects, especially when he speaks of whether the dentist of today is a better dentist than he of twenty years ago. I certainly believe he is. If this were not the case, I think the outlook would be very discouraging. He is a better dentist, because he is able to recognize the value of bacteriology. He is a better dentist today because he knows that when he puts something on an exposed pulp it is not a question of what it is, but it is a question of pulp infection. In the early days of dentistry, when Atkinson taught us all that when he applied oxychloride of zinc to a pulp it would keep that pulp from dying, the question of infection did not enter our minds at all. We knew nothing about it. Therefore, the dentist of today is a better dentist, because he recognizes these facts.

Dr. Darby tells us what, in his estimation, this added fourth year shall be devoted to in the curriculum. Has it not occurred to us all that the subject of irregularities, the great field of orthodontia, is enough to occupy a man's time in the fourth year, if he did nothing else, and even then he would be far from a master in that subject at the close of the year. He could take up work in porcelain, which was not taught twenty years ago, as it is today, and put in all his time on it, and still he would not be a master in that department. With the advent of crown and bridge-work, porcelain work, with a knowledge of bacteriology, a better knowledge of physiology,

which has been revolutionized in the last twenty years; with these I hold that the dentist of today is a better man, a better dentist; and the student of today is superior in his training as a dentist than was the student of twenty years ago. So when we sum up the work that is being done today and analyze the work of twenty years ago, I think we must come to the conclusion that the dentist of today is a better dentist than he was ten or twenty years ago. And I am confident that with the addition of one more year, and with the work better systematized than ever before, the dentist of ten years hence will be vastly superior to the dentist of today.

DR. A. H. PECK, Chicago:

I listened to the excellent address of our President with much pleasure. I was particularly impressed with the liberality displayed throughout the address. I was especially interested in the subject of physical diagnosis, a subject which is to be brought before you more specifically by another gentleman later in the program; a subject which has been of great interest to me for a long time, and I may add that if it is possible to say truthfully of me that I have had any hobby, it is this subject of physical diagnosis. It is one on which I have laid special stress ever since I have been teaching.

I am also pleased that the discussion in the main has taken the turn it has, a consideration of the curriculum in general. I believe that this is the place for us to discuss the college curriculum. We have assembled in this association none but individuals who are interested in teaching and in getting at the best methods for carrying on their work. I wish that it would be possible for this association to give more time to the discussion of this subject, and that before an adjournment is taken a committee would present to us in crystallized form an outline of a college curriculum, based on a four years' course, that would be acceptable to all the colleges. This is a much better place and time for the consideration of this subject than the National Association of Dental Faculties.

DR. J. H. KENNERLY, St. Louis, Mo.:

The principal thing for us to do is to see if we cannot come to a unanimous opinion as to what the work of the fourth year should consist of. The suggestion was made by several of the speakers that

the state boards of dental examiners adopt the plan of the board of medical examiners of the State of New York; that we give our students final examinations at the end of the second and fourth years of their course. You must remember in this connection that in many of the states of the Union examinations are not required for graduates. They are not required in this state nor in many others. If you are going to force these students, as I understand it, to be examined by State Boards every two years it would be rather an expensive procedure for them, especially in those states where they must be examined before they can practice.

With reference to the work of the fourth year: I agree with those who said that there is nearly work enough as it stands today to cover the four years if it is properly divided. But I cannot agree entirely with the speaker who said that the fourth year should be practical entirely. I believe that some didactic instruction should be given throughout the entire four years. According to my recollection of the recommendations offered by our President, we teach in the school with which I am connected all the subjects save two; and those two are physics and physical diagnosis. We go very thoroughly into chemistry, pharmacy and metallurgy so that we have but very little to add to our curriculum. The question now is,—where shall we add it?

Dr. G. V. Black, Chicago:

I would like to speak on one point that has been referred to in the discussion by one of the speakers. It is a very important point, too, in connection with this matter of education, and we should strive to understand it. The education of the machinist has been referred to, and the fact mentioned that it requires four years to make a machinist. During these four years this man may spend all his time solely in the machine shop; solely at practical work, so that he may become able to turn his journals to a nicety, cut a toothed wheel perfectly, adjust his machines perfectly, do excellent mechanical work, but if this man has not during this time been studying his mathematics and his physics, the laws of motion; and if he has not been studying mechanical drawing and all those things, he will be simply a mechanic to be directed by the master; nothing more.

Now, gentlemen, we may make men who will fill a cavity well; we may produce men who will make a plate very well, indeed, but they are like the mechanic who has stuck to his machine shop. They are men who can work only when directed by others who have had a superior education along the lines relating to the specialty they fell into in dentistry. We expect to so equip each man that he will be a master, and until we do that we are not making the dentist we wish to send out to practice. Of course, we do not expect to do all this in four years, but we must give him the basis upon which to work in the future in his practice that he may work himself up on this point.

Dr. D. R. Stubblefield, Nashville, Tenn.:

I want to present, first, a congratulation; second, an expostulation, and, third, a corroboration.

I want to congratulate our President upon the address in its entirety; broad, comprehensive, logical, intelligent. This association is to be congratulated that we begin to look at subjects so broadly. We are reaching a point where we can look over the field and intelligently decide what is best to do, and we can intelligently direct our means. As the exponent of conservative wisdom, to which we are trending, I congratulate our President in making such a showing.

My expostulation is that though all this is good, exceedingly good, yet it is utopian. I do not believe that we can accomplish that much. I am convinced that we have taught too much in the time at our disposal, with the result that we have produced a mental dyspepsia rather than assimilation, growth and development. What we want is not ingestion but digestion, so as to permit our men to grow broad and strong. We have not had sufficient time to mature. We have a smattering of many things, but "a little knowledge is a dangerous thing," and unless you drink deeply to sober yourself again you are intoxicated to your own downfall. I have always looked upon the college and the teacher as a foundation building combination. No school teacher expects to perfect his pupil, but merely to give him the material and the opportunity that Dr. Black spoke of to make himself. Put the student in the way to help himself; that is the best you can hope to do with him. Did a teacher ever

make a man? No; there never was a man who was not self-made. There is no power on earth to wake up what is not in a man, and make a man of him.

We have not been able in this short length of time to give the young man a chance to come to himself; to understand what he has been filled with. Therefore he has staggered along and done as well as he could. The wonder is not that so few have succeeded but that any at all succeeded from the stuffing process in vogue in our colleges. We have cause to congratulate ourselves that some men have had intellectuality enough to digest all that was given them and make use of it.

And now the corroboration. The intelligent presentation of this extensive possible course is very gratifying. But I am satisfied, at least from my own standpoint, that what we need is more time and the cultivation of judgment. I believe that if Dr. Darby is to be sustained that it occurs out of the fact that the course was limited and the man big enough and strong enough to master that which was presented. Even in the limited time at his disposal he managed to get more out of the course than do most of our students today. He was a thorough practitioner, a man who knew; a man who could do things. It is not so much what you know as what you can do. You never know a thing until you can do it yourself.

Dr. Edmund Noyes, Chicago:

It appears to me that those who have discussed this paper are several steps behind the President's address. We do not want to add a fourth year to our dental course just to put on an extra frill or two. We must have a four years' course because we cannot do all the work in three years that ought to be done. Then we must have a hospital course or a laboratory course in special investigation work, or something of that kind. Both these things are important. Gentlemen, the greatest need of the dental profession today is to make professional men instead of artisans. We are in greater danger than most men realize, of becoming a company of skilled workmen instead of a great profession.

Previous to twenty or thirty years ago we had a few professional men in our ranks, and we had a great many mechanics and artisans, and if we are not careful the time will come when we will have the

same thing again, and it will be the fault of the colleges if the rank and file of our practitioners are merely skilled mechanics and business men instead of being professional men. We shall not be without professional men, because many will become such by force of personal character, ambition and attainments. But the purpose of dental education ought to be to lift up the whole number of graduates into professionalism. If you are going to do that you must make students as well as operators and mechanical men. In order to do that you must teach them something of those sciences which are at the foundation of all professional knowledge and practice. You must awaken in the students some interest in these subjects; give them time enough to learn something about them, and the four years' course should be used more for the purpose of strengthening this aspect of dental education than for anything else.

I do not wish to disparage for a moment clinical or technical instruction; in fact, it should be made stronger rather than weaker, but the weak side of dental education today is the scientific and the professional side.

The most important thing this association can do is to ascertain and agree upon what should be taught in the first year of the four years' course. We must begin that next October, and if we know just what we are going to teach in that first year of the full four years' course we can agree upon the second year's work in time, before the second year is begun. But if we talk in general terms, as we have done so far, we will not arrive at any conclusion, and the new term will be upon us without finding us ready to say just what those students should be given for their work in the first year.

Dr. Geo. V. I. Brown, Milwaukee:

Some years ago I had occasion to take up this subject before this association. I at that time made some calculations as to the actual amount of time that we place at the disposal of students during a seven months' course, and it became clear to me that there were not hours enough in which to teach properly those subjects which were embraced in our curriculum at that time. As nearly as I can remember the figures at this moment, in a seven months' course, if you could work the student for eight hours a day he would have in actual time less than 1600 hours. Anatomy, three times a

week, gives him between 80 and 90 hours of anatomy. You cannot teach anatomy, even such a small amount of it as dental colleges must require in that length of time. When you figure out the time the student puts in on each study you will find that it approximates about 70-80 hours for each branch. Manifestly it is impossible to teach those studies thoroughly in any such time as that. There is the greatest possible need for this fourth year in order that those subjects which are being taught at this time may be taught properly and still give the student sufficient opportunity to digest what he is expected to learn and understand.

In this estimate we allow only fifteen hours a week for laboratory work and practice in the infirmary, which is certainly considerably less than it ought to be. It seems to me that this association can do no better than to first consider the time that it is going to recommend for each particular branch, allowing a little additional time which will go with the fourth year, and then take up the very timely suggestions of our President with regard to additional study. I think the less time we spend discussing whether dentistry is a specialty of medicine the better for all concerned.

Until we can practice dentistry without pathologic conditions of any kind, or can prove that diseases of the mouth and teeth have no share in disease elsewhere, we must acknowledge a relationship to general medicine of some sort. What that relation is to be will depend very largely upon how we deal with just such matters as are properly before us for discussion at this time.

DR. W. E. GRANT, Louisville, Ky.:

These remarks are all very good and in line with what I have felt as to the disposition of the fourth year; yet it is wasting valuable time to talk about this matter without arriving at any definite conclusions. We have a Committee on Curriculum, and I do not see why that committee cannot report at this meeting. They may offer us the solution of this vexing problem. It is not a question as to what to do with that additional year, but how can we get the most good out of it; what subject or subjects ought to have the preference over others. Some of them are more important than the others, and it is for us to determine which of these subjects are of the most importance to the future dentist.

TEACHING PHYSICAL DIAGNOSIS.

By J. M. Patton, M. D., Chicago.

Mr. President and Gentlemen:

The invitation to present to this association a paper on the teaching of physical diagnosis to dental students brought to my notice two features pertaining to this subject which, while not unrecognized, yet had hitherto been not fully appreciated. These features are the absence, until a comparatively recent date, from the curricula of dental schools of any instruction in physical diagnosis in its relation to the administration of anesthetics, and the fact that in some quarters there has been manifested a spirit of cynical doubt as to the advisability or practical utility of introducing this branch of medical learning into dental pedagogics.

The recent introduction of instruction in diagnosis into the course of dental schools is but one of the evidences of advancement along the lines of a more general and thorough education for dental students which marks the educational methods of to-day, others of which are the courses in physiology, chemistry, anatomy, and bacteriology. Some of these are of comparatively recent introduction, and the previous apathy relative to the teaching of physical diagnosis in dental schools is to be charged against the same lack of recognition of its relative importance to the administration of anesthetics as has hitherto marked the general medical profession in regard to the employment of skilled anesthetics who have some knowledge of the physical conditions and physiologic possibilities of the organs within the chest, relations which the medical profession are but now coming to fully appreciate.

Regarding the propriety of teaching physical diagnosis to dental students there appears to me to be but one conclusion, and that is that it is not only proper but absolutely necessary, if we are to educate dentists who are capable of not only administering an anaesthetic properly, but who also have some judgment as to the propriety of its administration in the individual instance.

There are those who maintain that the latter faculty is beyond the possibilities of an education in dentistry, and is not a legitimate fea-

ture of dental practice. I am not here to controvert special argument, but, to quote Milton, "Ink doubtless, rightly applied with some gall in it, may prove good to heal this tetter of pedagogism."

Two questions arise in this connection: First, what necessity has a dentist for a knowledge of physical diagnosis? Second, to what extent is it necessary or advisable for him to carry this study?

An affirmative answer to the first of these questions hardly needs argument in its support. If the clientele of the dentist of to-day exhibited the characteristics of that old Countess of Desmond who, as related in Bacon's natural history, "lived till she was seven score, did dentize twice or thrice, casting her old teeth, and others coming in their place," it is probable that I would not be imposing myself at this time on this association. However, as modern life is not conducive to senile dentition, we must expect the painful features of dentistry to endure. We must not expect that the modern tendency to specialize in the field of anæsthetization for dental purposes will obviate the necessity for direct and correlated knowledge of anæsthesia on the part of the general practitioner of dentistry. It is not always possible to utilize special services, and even if it were it does not entirely eliminate the responsibility of the practitioner to his patient in this connection, which calls for the exercise of his individual judgment irrespective of his personal conduction of the anæsthesia. We might here paraphrase Sir Thomas Browne to the effect that "they do most with anæsthetics who could do much without them." Because a dentist does not extract he is therefore not relieved of all responsibility to his patient in regard to the employment, by some one else, of anæsthetics for extraction.

Admitting the necessity of the administration of anæsthetics by dental practitioners, the importance of a knowledge of not only the physiology of the organs of respiration and circulation, but also of the evidences of abnormal conditions of these organs, especially as far as they relate to the administration of anæsthetics, is self-evident. To minimize or deny this importance is to acknowledge a want of appreciation of the principles which to-day govern the administration of anæsthetics. These principles embody not only a knowledge of the chemical nature of these agents and of their physiologic effects but also of those physical conditions of the chest and its contained organs, as well as conditions of the kidneys, blood, and general health

as may modify the physiologic effects of anæsthetics, and materially affect the extent or method of their administration.

Sentiment alone, though having no place in scientific study, has sufficient historical relation to this subject to justify a more thorough education of dental students in this branch. Who discovered the practical utility of anæsthetics? Morton, a dentist. What manner of man was he who seized opportunity, presenting in the form of Eben Frost with a painful molar, to demonstrate that though the nepenthe of Homer might be mythical "science has control of pain"? Morton, a dentist. For without discussing the claims of any one to the right of discovery of anæsthesia we may quote Sidney Smith to the effect that "He is not the inventor who first says the thing, but he who says it so long, loud and clear that he compels mankind to hear him." In this sense at least Morton's title is clear and supersedes the earlier observations of Wells. Did he not succeed where the latter failed, at the same place and before practically the same audience rendered cynically antagonistic because of the previous failure? Thus the historical interest associated with this subject gives every true dentist an incentive for the study of conditions allied to the administration of anæsthetics.

The principal questions of interest in this connection are, however, To what extent shall physical diagnosis be taught to students of dentistry? and How shall this study be carried uot?

It has been maintained that because of the impossibility of giving thorough, practical courses in physical diagnosis in dental schools to students who have no knowledge of the pathological changes upon which physical evidences of disease depend, therefore it is unnecessary and impracticable to teach physical diagnosis at all. This is shallow argument. Is the bacteriology taught in your schools useless because you do not make expert laboratory workers of your students, and fit them for original research? Is the physiology taught in your schools useless because you may not teach the chemico-physiologic relations between metabolic processes and the so-called xanthin or purin bodies? Not at all. Neither is it necessary that a dental student should be taught the bisto-pathology of diseases of the chest in order to appreciate certain facts about such conditions that relate directly to the administration of anæsthetics. We should not expect

to make expert diagnosticians of dental students. For him the differential diagnosis of complicated heart lesions is unnecessary. The soundness of his judgment as to the nature of a pleural inflammation does not enter into the matter. His ability to locate a cavity in the lung is beside the question.

I do not mean that these conditions are of no interest in this connection, but that their proper interpretation demands a degree of skill not to be required of a dentist, any more than you would expect technical knowledge of prosthetic dentistry of a physician before allowing him to decide as to the necessity of treating a tooth cavity.

As far as the heart is concerned in its relations to the administration of anæsthetics, leaving out of the question reflex or other inhibition of apparently healthy hearts and confining my remarks to judgment based on objective examination, the whole matter rests on the integrity of the heart muscle, and not in the mere presence of arrhythmia or of valvular lesion, a matter in which reliable judgment postulates most extensive experience and observation. Even marked degrees of hypertrophy and dilatation may not contraindicate the administration of anæsthetics provided the muscle be fairly good. It is obvious that even the most expert may be deceived, and the behavior, under anæsthesia, of some hearts that give every evidence of muscular degeneration and cause us to dread the necessity of anæsthesia, is often surprising.

We should not expect to teach dental students to become expert in judging such cases, but they may be taught the recognition of physical signs that will present to them either the absence of dangerous elements, or the presence of such conditions as render it advisable to divide the responsibility of the administration. I have examined patients who had been told both by physicians and dentists that they could not be given any kind of an anæsthetic safely, and in whom no contraindication to such administration could be found. Upon the other hand, I have examined patients who had taken an anæsthetic without preliminary physical examination, and in whom prolonged or profound anæsthesia would certainly be dangerous.

Having acquired an understanding of the gross anatomy and the essential physiology of the organs of the chest, the physiology of the blood, together with a knowledge of the physics of the diffusion of

air in the lungs and the interchange of gases with the blood, essential knowledge in which, I am afraid, the average senior dental student is deficient, the student is then fitted to study physical diagnosis in its relations to the administration of anæsthetics.

He should now be taught the normal character of the heart rhythm and sounds, the characteristics of the normal pulse, the features of normal lung action and its respiratory murmur. This preliminary instruction in the normal physical signs is a very much neglected study even in medical schools.

Having acquired this knowledge, the student should then be taught the main diagnostic features of a cardiac murmur, how, when, and where to detect it. The differential diagnosis need not be considered. The nature of cardiac enlargement, hypertrophy and dilatation, and its relation to the signs of displaced apex beat, and increase in the area and force of impulse should be considered. The modifications of the normal heart sounds caused by disease should be studied, as should also pulse changes and their relation to dynamic ability of the heart. Abnormal conditions of the lungs and pleura should be considered as far as they relate to modification of respiratory capacity and obstruction of the air passages, chiefly in relation to the signs obtained by auscultation. Expertness in palpation and percussion is not essential.

The general features of blood conditions which result in degrees of anæmia which may prohibit the exhibition of anæsthetics should be considered.

The principal elements of urinary diagnosis should be taught in relation to the detection of the possible presence of kidney lesions, at least as far as chemical analysis as ordinarily taught for this purpose is concerned.

As to the general method of instruction in physical diagnosis, there is only one practical way, and that is by actual demonstration on subjects. More actual knowledge can be obtained in this way in one hour of work than in many hours of didactic instruction.

Every student should have opportunity for objective study. This method necessitates demonstration to small classes or sections, and the ground outlined can be covered in a series of from eight to ten demonstrations, and should be supplemented by quizzes in order to bring out and correct the individual students' errors.

Such a course of instruction will enable the student to obtain from his course on general anæsthesia much information which must otherwise have fallen on stony ground. Infonnation which will be of immense practical value to him in his professional work, not only to enable him to administer anæsthetics with greater skill and efficiency, but which will also enable him to judge when it is necessary or advisable, on behalf of both himself and his patient, to obtain additional advice in relation to the possible danger of the administration of an anæsthetic.

The fact that the principal dangers, fatal and otherwise, attending the administration of anæsthetics, are of asphyxial or circulatory origin, emphasizes the importance of a knowledge of physical diagnosis on the part of the administrator of anæsthetics, for while such knowledge may not prevent the fatalities resulting from anæsthetics, all of which are not preceded by evidences calling attention to their imminence, nevertheless observation of and attention to the evidence obtained through a proper physical examination may do much to lessen both the frequency and the dangers of the various complications which are liable to arise during the administration of anæsthetics, and to some extent may affect the frequency of serious consequences arising therefrom.

The teaching of physical diagnosis in dental schools is already a fact. This cavity in the dental curriculum is being filled with golden knowledge. The students want it, and are capable of assimilating it. It has come to stay.

I desire, Mr. President and Gentlemen, to acknowledge the courtesy of this occasion, and to thank you for the attention which you have given to a paper which by no means equals in interest the subject with which it deals.

DISCUSSION.

R. H. HOFHEINZ, Rochester, N. Y.:

The paper expresses my own views so closely that, even if I were well enough, I could not add much to it.

There are some things in education which must be trusted to the individual judgment of a pupil and tend largely to his intellectual development. There are other things that summarize the results and

become a part of memory. There are some things which, however, can only be studied by demonstration; yes, by actual contact. Among these belong the study of physical diagnosis. The student must commit the act.

Anything that will add to the broadening of dental education and its naturally good results should be joyfully accepted by all earnest minds in the profession. If anything new is to be added to the dental curriculum of the present time physical diagnosis is the branch which is mostly needed. Though the period in which most of the dentist's time was consumed in extracting teeth is of the past, anæsthesia will ever remain a necessity in dental practice.

I have always argued that a dentist should not trust his own diagnostic ability regarding the patient's heart and lungs, and, therefore, never give anæsthetics without consulting a medical practitioner. Why? His professional training did not equip him with the familiar sound of a normal or abnormal heart, nor was he generally able to diagnose complications in the breathing apparatus of his patient.

With this branch taught in college, the dentist possesses every reasonable qualification to anææsthetize his patient and bear the scientific and moral responsibility of a possible accident. It is, however, not only for this purpose that physical diagnosis should be taught. Dr. Peck well expressed it in his paper before the American Medical Association when he said: "I hope to see the time when a dentist will inquire into the health and symptoms of his patients before deciding on the amount of work that is proper and safe to be done at any one sitting, as should a physician before prescribing a certain amount of a drug that is to be given a patient." Yes, indeed, this is an essential necessity. How many patients are kept away from judicious and timely dentistry because the last operator lacked all judgment regarding the patient's physical endurance. We may go beyond that. How many dentists fail in diagnosing their own physical ability? How many laborious operations do we begin with brilliancy and end with mediocrity? Why? Because we have failed to recognize our limitations—failed to recognize our own physical status at that particular time. Many fine minds and hands have been made passive because the owner lacked a fine, discriminating power of physical diagnosis regarding his own and only corpus.

Under the present three years' course of study but little time will be left for the teaching of physical diagnosis. I have no doubt, however, that the coming four years' course will give sufficient room to a branch of medical science which is as essential to a practicing dentist as physiology. Prophylaxis, which in future will form one of our greatest functions, will change the requirements of the dentists of the past; but though the future dentist may be called upon to less frequently use anæsthetics for dental operations, may be less called upon to perform the long and exhaustive operations of the present time, he will be more called upon to use a broader and more comprehensive knowledge of the medical sciences.

The paternal branch of medicine from which dentistry emerged will assimilate this ramification again as soon as dentistry modifies its frequently alarming showy technics and becomes based on science and prophylaxis only.

Dr. T. B. Hartzell, Minneapolis:

Mr. President and Members of the Association:

It is an honor and a privilege to discuss this able paper presented by Dr. Patton. His views, so clearly presented to us, must meet the approval of every dental teacher who has given this subject consideration.

Personally, I thoroughly believe in the ideas presented, and only differ from the essayist as to the scope of the field physical diagnosis should cover. In view of this fact, I will not occupy your time further than to commend the paper and to suggest wherein we can make physical diagnosis of still greater value to our dental students and to the profession.

As one reviews the thought presented by Dr. Patton, one is impressed by the fact that he limits the field of physical diagnosis to its application in anæsthesia and one would also infer that to be able to fairly judge of the condition of the circulatory and respiratory system covered the most important ground of value to us. His idea seems to be: Investigating the blood, only so far as relates to the exhibition of anæsthetics, dismissing the kidneys with ordinary chemical analysis of the urine, and, while he does not so state, I infer such analysis is undertaken for its bearing on anæsthetic work alone.

Now, while every idea presented, without exception, is good and valuable, I certainly think that the field of physical diagnosis is of far greater scope, and the branch must and will be taught in many schools, and is taught now in a few, in such a comprehensive way that the student gains a conscious power and ability to be vastly more useful in his profession than if this branch is taught only for its bearing on general anæsthesia.

Dental teachers are more than ever awake to the fact that from 30 to 50 per cent of teeth lost by the American people before the sixtieth year of life are lost from causes other than caries, and that systemic conditions exist which account for this loss is equally true; therefore, sufficient general pathology should be given the student to pave the way for comprehensive teaching of diagnosis of these conditions.

For instance, the student should know sufficient physiology and pathology to comprehend the significance of variation in specific gravity, color, percentage of urea, total number of ounces of urine eliminated in twenty-four hours; also the significance of the presence of sugar, albumen or casts.

The time is coming when internal medicine will recognize in œdematous gums a more valuable diagnostic sign than the presence of fluid in the areolar tissue under the orbit, because it is a more delicate symptom and earlier makes its appearance than does the second condition, and just as surely points the searcher to the vital fact to be taken account of—namely, imperfect elimination of waste products which the kidney should convert and remove. Right here I might emphasize the fact that in anæsthetic work the condition of the kidney as regards its health is almost, if not quite, as important to the anæsthetist as is the condition of heart or lungs, for who has not seen acute uræmia follow the administration of ether occasionally? The students of the future must be taught these things to gain the greatest success.

The diagnosis of pathological conditions found in the oral cavity due to faulty elimination of the products of metabolism must and will receive greater attention in our coming four-year course. The investigation of the saliva for its diagnostic value is particularly in our field; should we not profit by it?

The investigation of the blood has helped us to valuable knowledge and will help us to more if we take advantage of such investigation; and think for a moment how much physical diagnosis along dental lines owes to the microscope? I will not stop to enumerate, for I know you agree with me that our field for physical diagnosis extends beyond the limits set by the essayist.

The relation diseases of the stomach and bowels bear, also the relation that acute febril diseases bear, to the development, existence and loss of teeth presents an interesting field for diagnosis, and one in which progress has already been made, and a field in which medicine can learn much from us. Our knowledge of anatomy, physiology and pathology of the nervous system is being so correlated with physical diagnosis that it is of great value to us in some of our most perplexing problems. For to fairly judge of the condition of the nervous systems of the people who come to us for service and to govern our actions thereby is of greater value to our patients than many of the things now taught, and should receive more attention in our course.

The diagnosis of contagious diseases, particularly of syphilis, is of vast importance, for the safety of both patients and dentist depends upon its recognition and the observation of rigid prophylaxis.

How many of you here present would care to trust yourselves or your families to the care of a man lacking the ability to diagnose this phase of disease, foryou would be apt to argue that lack of ability to recognize would entail faulty prophylaxis.

The fact of the matter is that our men should be so grounded in knowledge of disease and diagnosis as to enable them to take stock in the general condition of the patient, and of the special conditions directly affecting the teeth, more thorough and careful training than even medicine can give.

The man who limits his practice to operative and prosthetic dentistry is from one-half to two-thirds a dentist, and our coming four years' course will in many schools afford instruction that will supply the missing third, and I trust the whole weight of influence of you men who are our leaders in dental progress will be given toward the rounding out of this part of a dental education.

Dr. D. R. Stubblefield, Nashville:

The Institute of Dental Pedagogics should deem itself fortunate

in being able to enlist men who can so intelligently and scientifically discuss a question as the essayist in this case. As an individual member, permit me to thank him for the privilege of hearing his timely and agreeable disquisition. He has been governed by the time-honored maxim, if I may copy him in quoting wise saws, that "what is worth doing at all is worth doing well," and right well has he done it. He has given us a logical, concise, yet thoroughly comprehensible exposition of his subject, and as one who has had the opportunity of thoroughly digesting it, I wish to suggest to the membership the propriety and expediency of reading it over more than once when it shall appear in our transactions. It will repay you abundantly.

For these reasons, as well as others not so obvious, a discussion by me must be largely a corroboration and hearty approval. "Regarding the propriety of teaching physical diagnosis to dental students," he says, "there appears to me but one conclusion, and that is that it is not only proper but absolutely necessary if we are to educate dentists who are capable of not only administering an anæsthetic properly but who also (should) have some judgment as to the propriety of its administration in the individual case." All must agree with that, if the dignity and worth of dentistry is to be maintained. That its study and full comprehension should not have been deemed essential from the outset of all effort toward dental instruction is not only a reflection upon the founders of institutions so intended, but is also quite remarkable. The institution with which I am most familiar, claimed from its inception to try to teach in its curriculum everything vitally necessary to a proper educational equipment of practitioners of dentistry, and yet I am certain physical diagnosis, as such, has never been extensively offered. All dental colleges, I feel assured, teach and have always taught a technical physical diagnosis. A differential dignostic skill is absolutely essential in the daily routine of every intelligent dentist, and the man who doubts this merely publishes his own ignorance of our profession.

It seems entirely a work of supererogation to discuss the propriety of its being taught, and the questions only remain as to how far we ought to go, how much we should strive to accomplish and in what way. It is all but axiomatic that if a dentist ever does give an

anæsthetic at all he sould know whàt is essential to qualify him for such an operation. The surgical procedure may range from minor to major, but anæsthesia never falls below the plane of its highest possibility and should never have degrees of comparison in the mind of a conscientious operator. Again, it is equally certain that every dentist, especially those outside of the realm of the extracting specialist and therefore the expert anæsthetist, has to exhibit general as well as local anæsthetics more or less frequently in his work. Therefore, it goes without saying any instruction short of complete instruction is not enough, and does not accomplish the end aimed at, as the reason for its existence in any degree whatever. Diagnosis means known throughout, and any partial knowing is only that degree that has been rightly termed a dangerous thing, and should never be tolerated where drinking deeper is possible and better. My personal conviction is that an ideal can never be too high, for there never is growth and development without stretching in mind, morals or muscle. If there is any mistake made in our work it behooves us to make it by attempting to attain higher than reasonable demand. But whatever is decided as to the degree of proficiency to be attained, I think this subject will be one of the most valuable additions rendered available in the four-year regime now at hand. It will constitute one of the most important links in the golden chain of a thorough dental education.

Again, the essayist declines to raise his voice in argument against those who maintain that the "latter faculty," as he calls it, meaning full instruction, is beyond the possibilities of an education in dentistry, but I have no such compunctions or hesitation. Why should dental schools hesitate to attempt in four years of seven months each, what medical schools claim to teach in four years of six months each? Can they claim that their material is better, better educated and more mature than is the average found in the schools of the National Association of Dental Faculties? Has it ever appeared that any educational requirement is obligatory before matriculation is possible in even the best of our medical schools? No, no such superiority exists in material to be worked on and must be found in a better or more thorough method, if found at all. Indeed, we have a right to claim that our higher fixed educational requirement gives us a better chance to produce good results. Be

that as it may, the fact remains that to teach this subject well requires that specially selected clinical material be procured. It will be difficult, but not insuerably difficult. It is no easy matter for medical schools to do it, with all their outside clinic to draw from, but there is no patent right on poor, sick folks that I am aware of, and every dental faculty can command the situation if it wishes earnestly enough to accomplish things. Without posing as a prophet, I will venture to predict that such perfect practical results will be shown from those schools that survive the strenuous life the four-year rule will usher in, and each institution present could, if modesty did not prevent, disclose one of those fittest to survive.

The question is, how far shall we attempt to go in the matter? I fear that all will not agree with me in saying, the farther the better, but that is my unalterable opinion. Our essayist has made a most clear-sighted and judicious limitation, and I shall vote to endorse his views as the next best measure. Nevertheless, it occurs to me that the man who can have but little daily opportunity in after life to become proficient in such an important equipment, should, as a student, get the best possible training at college. The medical practitioner enters a school of physical diagnosis the day he commences to practice, and he should become more expert as the years go by, which is in direct opposition to the condition of the dentist, who will be compelled only occasionally to attempt an exhaustive physical diagnosis. Therefore, I repeat, that just as the dental student is given the basis for differential diagnostic skill in the special domain of his own work in the four sessions, it is not beyond reason to assume that he may be taught physical diagnosis more generally and just as thoroughly in the same time if the requirement is made. That he should not be called upon to make a critical differential diagnosis as often as the physician, or that he should not be called upon to make one at all, is no argument against the wisdom and safety to his clientele that would be found in his ability to do so if it were suddenly demanded of him. A practitioner of either medicine or dentistry, unlike a chain, is to be measured by the highest possible demand in his calling, his strongest instead of his weakest link, as it were. Having come into dentistry by the doorway of medicine, I have always been unable to look upon my calling as less important than the practice of medicine in any of its special branches and any

view of its essential demands has never fallen short of the widest possible culture. Too long has the world at large been given, directly or indirectly, a narrow view of the importance and dignity of dentistry, and this idea will never receive its absolute quietus until the question has been settled in the breadth and thoroughness of the scientific qualifications found in our curricula.

DR. A. H. PECK, Chicago:

I am glad these three gentlemen have preceded me for it leaves little for me to say, and I have never been anxious to discuss any subject unless I had something new to present. I am gratified, however, that the subject of physical diagnosis commands the attention of the dental profession in connection with our college work that it does. As I stated before, this is a subjcet that has engaged my attention for a long time and, if you will permit me to repeat, ever since I have been teaching in dentistry I have harped upon this subject. I believe that there is nothing in connection with the equipment of the dentist, in the broadest sense of the term, that is more essential than an intelligent understanding of this subject. The ability to diagnose accurately local conditions, and also conditions of a systemic nature upon which many local pathologic conditions depend, is one of the most important of our qualifications and I am glad that a number of our colleges have considered this subject of sufficient importance to give it a separate place in the teaching force, and I hope that in the very near future all of the dental colleges will give this subject the place on their curricula that it deserves.

As Dr. Hartzell says, I would differ only in the scope of the application of this subject in teaching dental students. While I believe that it is impractical at the present time to undertake to give a course to dental students in this subject, as broad and comprehensive as the course that is given to the medical students, yet I do believe that such a course is exceedingly desirable, and if it were possible, considering all the conditions with which we have to deal today, I should most certainly heartily support any movement which has in view the inauguration of a practical course in physical diagnosis. It is very essential that the dental student leaves his college with a mental equipment in physical diagnosis that will compare favorably with his knowledge in any other subject.

DR. W. H. WHITSLAR:

An amount of physical diagnosis of dental patients under varying conditions is a necessity. This is especially true when the candidate is to be a subject of anæsthesia. It is well to understand some of the means of arriving at the diagnosis of disturbances of the heart and lungs. A short course in our curriculum is desirable and this, I believe, should be largely illustrated with manikins first, to recall the anatomy of the vital organs, then to localize the organs. Afterwards the human subject may be secured from the clinics and the student taught to recognize usual and unusual sounds of the thorax. In so far as the teacher is able to secure subjects, so will the value of the course increase. It must be averred, however, that physical diagnosis of lesions of the heart and lungs is not to be mastered in a short course. When cases in practice present themselves, however, that are eminently suspicious, that fact is all the more observant to the mind that has had some training, be it ever so little. This course should be clinical as much as possible.

There is another phase of this subject that seems to me sufficient to command attention under another chair. I refer to the examination of patients entering the operatory for the usual dental operations. While it often seems impracticable to devote much time on the part of students to the incoming patients as a body, yet I have had for a long time the desire to have systematic examination of every patient that enters the college. Many things are attained by such procedure. As a rule the patients are examined by a demonstrator, and he assigns them to respective operators, where mechanical affairs precede all other thoughts. Now, in the hands of a demonstrator, in a examination room for the whole purpose of examination, a student learns to receive a patient, seat him, observe temperament, condition of health, conformation of jaws and face relative to the teeth, mucous membrane of the mouth and throat, abnormal growths, presence of calculus upon the teeth, gingivitis, pericementitis, abscess and fistulæ, other pustular diseases, decayed teeth, and many other conditions that an intelligent demonstrator could teach the tyro to become observant, inquiring and intelligent. In this study the act of palpation would help the diagnosis of an abscess, and percussion the resonance of the tooth indicating its vitality. The senses of sight and smell are also called into use.

On the whole, I think that the establishment of instruction in diagnosis is of so much impotance that it is a wonder that it has not been introduced heretofore.

DR. FANEUIL D. WEISSE, New York, N. Y.:

The teaching of physical examination to dental students was commenced at the New York College of Dentistry about ten years ago. At that time a class was organized which every student of the second year has since been required to attend. It seemed to us that it was absolutely necessary that a dental practitioner should be able to recognize the normal pulse, normal heart sounds, and normal lung sounds; but, that it was not necessary that he should know how to differentiate abnormal heart and abnormal lung sounds. If he was able to determine that the pulse, the heart sounds or the lung sounds were not normal, it would deter him from administering an anæesthetic and lead him to direct the patient to his or her family physician for advice as to the propriety of administering an anæsthetic.

This class has broadened, since its organization, in that the class work now includes the practical demonstration of and drill in the application of measures to be carried out in the emergencies of syncope ,asphyxia, and hemorrhage—the dental surgeon should be educated to met these emergencies—in addition the students are taught the application of bandages to the head.

Each class consists of ten students, who examine and operate upon each other; the instructor of the class is a physician.

First—How to feel the pulse is demonstrated, what is to be recognized as the normal pulse and its age variations are noted. Each student then examines the pulses of his fellow students under the guidance of the instructor.

Second—The examination of the heart is demonstrated, and what is to be recognized as normal heart sounds is described. The students then examine each other—they being stripped to the undershirt.

Third—The examination of the lungs is demonstrated and what is to be recognized as normal lung sounds is described, and the normal ratio of the pulse to the breathing is given. The students then examine each other—they being stripped to the undershirt.

Fourth—The administration of an hypodermic injection is demonstrated, and each student administers an hypodermic injection of sterilized water to a fellow-student. The several drugs used for hypodermic injections are then enumerated, and the special indications for the use of each given.

Fifth—The subject of hemorrhage after extraction is dealt with; the various measures resorted to are enumerated and their applications described.

Sixth—The various methods of artificial respiration are demonstrated, and the students are drilled in practicing each method upon each other.

Seventh—The application of head bandages is demonstrated, and the students are drilled in applying them to each other.

Eighth—The treatment of syncope and shock are described and measures to be resorted to given.

A written examination is passed on the work done and the passing average is 75 per cent.

Dr. L. C. Borland, Chicago:

I was very glad, indeed, to hear Dr. Weisse's remarks on this subject, as I have been trying to carry off the credit of having introduced this great controversy among the dental profession. I first advocated the study of the heart and lungs by dental students about ten or eleven years ago. My object was to try and interest them in the heart, which they were compelled to take up in the dissecting room. Some seven years ago I brought to the college during the annual clinic two boys, one having a normal heart and the other an aortic stenosis. I had combination stethoscopes, so that ten or fifteen could listen to the sounds at the same time, and as the members of the dental profession passed through the room I asked them which of the two cases they regarded as the normal and which the abnormal; to which of the two they could administer an anæesthetic in safety. I was astonished to find how few of these men were able to distinguish between a normal and an abnormal heart. That may be taken as an evidence of the necessity of a course in physical diagnosis, at least so much of it as is of service and necessity to the dentist.

DR. PATTON (closing the discussion):

The advisability of teaching this subject appears to be admitted. As Dr. Stubblefield remarked, perhaps it was a matter of supererogation to introduce that question at all. I did not introduce this matter of teaching physical diagnosis because I thought there was any doubt in the mind of the dentist as to its place on the dental curriculum, but because there was such a doubt in the mind of the medical man. They think that the dentist should not be taught this subject because we cannot teach him enough of it in the short time placed at our disposal. I do not feel that way; I feel that the dental student can learn it and that he should be taught it, and that it will do him much good.

As to the question, how much of this subject should be taught: As I stated in my paper, I consider the subject from the standpoint of the administration of anæsthetics, but that is not the whole subject of physical diagnosis. A great deal more might be taught in the dental schools that would be of benefit to the dentist. The question is whether you are shaping your curriculum for the purpose of making a dental practitioner, or whether you intend to make a research worker of him. I do not believe that it is advisable at present to require every dental student to take a thorough course in physical diagnosis, including diagnosis of the urine, blood and all the secretions. Certain portions of diagnosis coming under the head of clinical diagnosis should be taught, and this should be done in the laboratory before the student reaches his course on physical diagnosis.

I think that the dentist should be educated to the point where he is able to determine if there is something wrong about the patient; knowledge that is of value in reference to the amount of dental work to be done on that patient; on the question of the advisability of giving an anæsthetic, or which anæsthetic, or how much of it should be given. Such a knowledge is of practical value to the dentist in his every-day work.

I have confined my paper to the question of physical diagnosis of the various organs in relation to anæsthesia, because I believe that is the most practical point from the teaching standpoint today. I believe with Dr. Borland that those methods should all be objective.

You can talk to a man for a week about a heart murmur and yet he will not know what it is. But show him that murmur, let him hear it, and he will know all about it in five minutes. I showed a patient to a medical student the other day; the student had been studying physical diagnosis for two years. I demonstrated a common point in a mitral lesion of which he had no knowledge other than the theoretical. In two minutes I gave him the necessary practical knowledge. That shows you the difference betwen practical and theoretical teaching.

The presence of a heart murmur has nothing to do with the administration of an anæsthetic unless there is some condition of the heart muscle which would contra-indicate the use of an anæsthetic. It is entirely a question as to the integrity of the heart muscle and that is something that you cannot teach the dental student, or any other student, in four years. He is lucky if he learns it in twenty years; that is, with any degree of proficiency. What the dentist should learn is to differentiate between conditions or murmurs; what a heart murmur is, when you can hear it, where it can be heard and how. He should learn that it is present and that is all. He has nothing to do with the decision of the question whether that murmur will interfere with the administration or not. That is beyond his scope.

THE SYSTEMATIC ARRANGEMENT OF LECTURES ON OPERATIVE DENTISTRY.

By C. N. Johnson, L.D.S., D.D.S., Chicago, Ill.

In presenting any subject to a class of students in the lecture room it is necessary, if the best results are to be obtained, to so arrange the headings that the order of presentation shall carry the subject in a regular sequence from the fundamentals to the minutest details. Not only this, but in a descriptive subject like operative dentistry, where the lecturer must picture with words the mechanical procedures of operations, he would better so plan his lectures that they follow as nearly as possible the order of the operation in the mouth. A student can better grasp a thing and retain it if it is presented to him step by step in its logical development with suitable landmarks at various points for the purpose, so to speak, of staking off the field of thought.

Different teachers probably have different ideas of what should be included in a course on operative dentistry, and no hard and fast lines can be drawn to divide the various subjects in such a way that it will apply to all schools. Each professor must arrange his work as best suits his individual needs and in a way to harmonize with the work of his associate professors in other departments. In the present paper no attempt will be made to specify in detail the topics to be considered in a series of lectures on this subject, nor to speak of the division of the work in the different years of the college course, but merely to use some of the standard topics as a means of illustrating the order of presentation to the class, and also to show how some of the topics may be divided into heads and sub-heads to make the lesson more vivid and the train of thought more systematic.

In teaching operative dentistry the class should first be impressed with the fact that no filling operations should be undertaken till the mouth is rendered hygienically fit to receive them—in other words, till all deposits are removed and the teeth properly cleaned. This involves at the outset a consideration of the subject of deposits on the teeth. This subject may be divided as follows:

KINDS OF DEPOSITS; source, how deposited, distinguishing characteristics, location, and deleterious effects of each kind.

REMOVAL OF DEPOSITS; instruments and instrumentation, appliances and accessories, materials for the removal of stains, with the technique of the operation from beginning to end. In this connection it is well at an early stage of the lectures to make the lesson more impressive by calling for a volunteer from among the students to take a chair in the front of the class. The lecturer then demonstrates upon him the different plans of procedure in the removal of calculus from the various surfaces of the teeth. He can show the best positions to be taken by the operator, the manner of placing the patient, the method of bracing the operator's hand to guard against injury to the gums in the use of push-cut scalers, and other valuable suggestions of a practical nature which the entire class can see and appreciate. A few minutes' demonstration of this kind will make a more lasting impression upon the class than a whole hour's cut and dried lecture, and wherever through the course an opportunity presents of making a demonstration that all of the students can see and grasp, it is well to do so.

When a thorough grounding has been given in the best means of placing the mouth in a hygienic condition, the class should be told how to instruct the patient in the care of the teeth—the methods of brushing, the frequency, and all of the relationship existing between patient and operator, with their respective responsibility in maintaining oral hygiene. No opportunity should ever be lost by any lecturer to inculcate the principles of true professional relationships in the minds of his students, and it so chances that in presenting the subject of operative dentistry these opportunities occur very frequently.

Keeping the patient always as vividly as possible before the students in the lecture room, the next thing to consider after "deposits" is the subject of dental caries. That would come next in the order of work at the chair and it should therefore come next in the lectures. The etiology of dental caries need not be dwelt on in detail because that belongs to another chair, but there is a certain phase of the disease upon which it would seem desirable for the lecturer on operative dentistry to express emphasis. This

relates to the manifestations of immunity and susceptibility, to the question of tooth material as it has or has not a bearing on the carious process, and to the possible relation of dental operations to the establishment of immunity in susceptible mouths. All of this has a most intimate relationship with operative procedures and it tinges the treatment of caries throughout. Then, again, great care should be taken to show the student the modus operandi of decay, the positions on the teeth where decay most often begins, with the reasons. This bears closely on the philosophy of cavity preparation, which immediately follows in its regular order.

The first thing to consider on this subject is the classification of cavities, with the reasons why cavities are so divided. Then take up the various classes and give each the special treatment it requires. For instance with proximal or proximo-occlusal cavities the first requisite in operating is to obtain space—with reasons. This at once takes us into a consideration of the significance of the interproximal space, the contact point, and kindred topics. When the necessity for obtaining space in contour work is thus impressed upon the student, the next step is to consider the different methods of separating teeth, with the indications for or against each method. This involves the question of materials for gradual separation, and the manner of using them; also the means to be employed in immediate separation or heroic wedging, such as the wooden wedge and the various kinds of separators, with the philosophy of force on which each one is based. In dealing with any appliance like the separator before a class of students great stress must be laid on the dangers from an indiscriminate and careless use of it.

After space has been gained the next consideration of the operator is to exclude moisture from the teeth during the operation, and this leads the lecturer into a study of the reasons why moisture is a bar to perfect work, followed by the various means to be employed to secure dryness. No detail of this should be slighted at this time, for instance when the use of the rubber dam is under consideration, it should include the kinds of dam, the size to be used for various positions in the mouth, the number of teeth to be embraced by the dam for each operation, the

manner of punching the holes, the detail of applying it, together with the means of securing it in place during the operation. This includes a study of clamps, the various kinds of clamps, the indications for or against their use, their abuse, how properly to use them, together with the same line of treatment on ligatures and other means of retaining the dam. No detail of the actual operation should escape attention at this time, and the same with other plans for keeping cavities dry beside the rubber dam.

When dryness has been secured the actual preparation of the cavity begins. With proximal cavities there are several chief considerations which stand out prominently as landmarks for the student's identification. The first is the outline of the cavity, which involves the question of extension for prevention and the philosophy which underlies it, the next is the form of the cavity walls for retention of the filling, the next the removal of decalcified tissue in the deeper portions of the cavity, with the issues at stake pro and con, and finally the preparation of the enamel margins.

Then comes the technique of the operation—the instruments used and the manner of using them. This latter is also to a certain degree a review of the preparation of the cavity, stating, as it does, the form of the cavity walls in outlining the instrumentation.

Each class of cavities should be considered in the same detailed way, and then a note made of the exceptional cavities which sometimes occur in such a manner as to well-nigh defy classification. Unless something is said on this point the student is likely to be puzzled on encountering a cavity which he cannot classify, and instead of using his judgment and studying out an intelligent plan of procedure he will frequently stand helpless in the face of what he conceives to be the unknowable. The aim should be in all college teaching to develop the individual thinking and reasoning faculty of the student, and the exceptional cases form an excellent medium for emphasizing this.

In connection with the preparation of cavities the subject of hypersensitive dentine comes up and must be considered in all of its phases, the medication (in brief), the instrumentation, and the temperamental control of the patient.

The next subject to be taken up after cavity preparation is

filling materials. The list of filling materials and their combinations in use at the present time should first be given, and then a detailed consideration of the physical character of each material and each combination. This leads to an observation of its advantages and disadvantages, together with the indications for or against its use. A brief outline may also be made of the methods of preparing filling materials for the purpose, though the chemistry of this subject belongs to another chair.

The method of manipulating and inserting the material in the cavity should be considered precisely in the order in which the operation is performed in the mouth. For instance, in dealing with gold, after studying the characteristics of cohesive and non-cohesive gold, the subject of annealing gold, and getting an insight into the various forms of gold on the market, such as crystal gold, deposit gold, etc., the question of the force to be applied in condensing gold naturally brings up the subject of pluggers and mallets. Before a mallet is used it should be well understood, and this involves a study of the condensing power of the different kinds of mallets, together with the philosophy and applicability of hand pressure. In considering the use of the mallet the effect of its impact on the peridental membrane calls for a close observation of the best methods of using a mallet, and also of suitable means for protecting the peridental membrane against injury from mallet force. With all of this vividly in the mind of the student, he is in a receptive mood to follow the insertion and condensation of the filling. The manner of building up the gold in the different classes of cavities should then be explained in detail, the placing of the pellets or cylinders of gold, the direction and force of the mallet blow, the form of pluggers for the various positions, and all of the minutiae of the operation to the final hardening of the surface of the filling by repeated mallet impact.

The next consideration is the trimming and polishing of the filling with the various appliances and materials for that purpose, thus carrying the operation to its logical conclusion.

This same method of treatment must now be carried out with all of the various filling materials, including inlay fillings, which latter require a very careful and a really specialized consideration

in view of the radical difference in principles involved from that of ordinary filling.

The next subject for discussion is that of the dental pulp. It frequently becomes involved in filling operations and might therefore be thought suitable for consideration in connection with the preparation of cavities, but it is a subject so different in character from that of filling teeth that it is deemed best to reserve it for a special place in the lecture course.

The approach of decay near or to the pulp raises the question as to whether the pulp shall be protected and saved or destroyed and removed. The indications for and against pulp capping should be very carefully considered in view of the importance of the subject, and then the methods given for capping the pulp in those cases where the indications are favorable. The different means employed for destroying the pulp in cases of hopeless exposure should then be considered with the indications for or against the methods. This involves a study of sealing agents for the cavity during treatment and all the means to be employed for safeguarding the soft tissues against injury in the use of escharotic agents in pulp destruction.

When the pulp is removed the next subject in line is the preparation of the canals for filling, the management of small and tortuous canals and all of the technique of this important operation. Then comes root filling, with the materials to be used and the manner of using them.

The consideration of dental alveolar abscesses in their pathological and surgical aspects comes under the head of other chairs, but the operative procedures involved are properly within the province of operative dentist— and may be considered at this stage. coming to—study and plan of

The stud—; each —ing attentio-me th— of erosion, abrasion and kindred topics also demand T' At th— from an operative point of view.

part— comes the management of children's teeth, the teeth of in—nervous individuals or those broken in health, and the teeth of elderly persons.

This, with a general summing up of the whole subject, and the practical consideration of the keeping of records of operations, and other office management so far as it relates to the conduct of the

operating room, rounds out what may be made a very complete course of lectures on operative dentistry.

In thus outlining topics for discussion no attempt has been made to arrange the details of the various topics except in one or two instances, very briefly, by way of example. It is left for the individual lecturer to formulate his headings in his note-book as best serves his individual purpose. This does not imply that this arrangement is a matter of secondary importance. In fact, to cover the subject adequately and with the smallest loss of time, it is of the highest importance that systematic and sequential headings be formulated for every topic, but in the opinion of your essayist this is as far as note-making for the lecture room should go. In other words, the lecturer should so prepare himself upon his subject that he does not require any prompting from his note-book except merely the headings, and those only for the purpose of keeping the subject running consecutively and to avoid any possible omission. The moment a lecturer has to consult his note-book for anything more than this, that moment he loses the magnetic influence over his class, which is one of the chief factors in every lecturer's success. Nothing in the way of reading from the note-book should ever be tolerated in a subject like operative dentistry, and if a lecturer finds it necessary to do this there is only one of two things for him to do—either make himself so familiar with the subject that it pours from him spontaneously without prompting, or else resign his chair and take up other work less laborious and more suited to his inclinations.

As a suggestion of how the headings in the note-book may be arranged for each topic, the following is offered as an example in cavity preparation:

PROXIMO-OCCLUSAL CAVITY IN BICUSPID.

1st. Cavity outline—Why?

2nd. Forming cavity for retention. Gingival wall—Why? Buccal and lingual walls—Why? Anchorage step—Why?

3rd. Removal of decalcified dentine in deep portion of cavity. Rules—with reasons. Treatment.

4th. Enamel margins.

5th. Technique of entire operation.

This may seem a very bare outline and yet those headings contain material enough for several lectures. There is no objection, of course, to a lecturer making a greater number of subheadings for his guidance, but the better way, according to the writer's notion, is for the lecturer to go over the subject the evening before his lecture, and so saturate himself with the topic that notes are unnecessary. There is an inspiration to the class in a spontaneous and off-hand presentation of the subject free from repeated recourse to the note-book and with the lecturer constantly looking his students in the eye, that can obtain in no other way. Not only this, but the details of treatment in the various topics of operative dentistry change from year to year as our ideas change, so that the re-writing of detailed notes each year would become burdensome. With headings this is not so much the case, and the changes necessary are very slight. This does away with the baneful habit of attempting to lecture year after year from the same old musty set of notes.

DISCUSSION.

DR. W. S. HOSFORD, Iowa City, Ia.:

MR. PRESIDENT:

I am in such thorough accord with Dr. Johnson that I cannot criticise anything he has said. I can only accentuate one or two points mentioned by him. First, the preparation of a diagram or syllabus of each lecture; this to be placed on the board so that each student can copy it and use it as a means for future study and collateral reading, as well as recitations on this subject. The use of teaching models and instruments for demonstration is also a good point.

Most of us are coming to the semester plan of dividing our college course; each semester to consist of nine weeks during which time the student is taught certain subjects or parts of subjects. At the end of each semester he is examined in that subject or part so that we can ascertain just what results we are getting in our work. I believe that is a very good plan. Personally, I wish to thank the essayist for the very clear and logical paper which he has presented. It cannot fail to be productive of much good.

DR. GEORGE E. HUNT, Indianapolis, Ind.:

According to his paper, Dr. Johnson does not begin teaching operative dentistry where I do. I first take up the anatomy of the mouth and endeavor to impress my students with the idea that I know all about the muscles of mastication and the osseous tissue entering into the oral cavity and its adjacent parts. I then take up the anatomy of the teeth and follow that with lectures and quizzes on development and on histology. I am then ready to talk on operative procedures. In these lectures I also teach oral pathology and therapeutics. To my mind oral pathology and therapeutics are inseparable from the teaching of operative dentistry. The same lecturer should handle these subjects. When I begin talking on the conservation or extirpation of the dental pulp I just have to talk pathology and therapeutics, and I do so.

I do not agree with Dr. Johnson that a lecturer should not write out his lectures. I do agree with him that the lecture should not be read. There is no chance for argument there. But I write out my lectures quite fully and take the manuscript to class with me. I may not look at it once during the hour but writing them out impresses them on my mind and I do not leave out things I had intended to say. It is before me simply as a memory refresher.

It has been argued that this method insures the lectures being the same year after year but that is not so with me. Every other summer I rewrite my entire course and all through every year I am adding copious notes to those I already have. In this way I am far more likely to be in position to give my students the benefit of all that seems good in operative dentistry than the man who relies on memory alone. In fact, the man who relies on memory alone is apt to be a narrow teacher. He teaches only what he does; other methods are neglected.

DR. HENRY W. MORGAN, Nashville, Tenn.:

It gives me great pleasure to add my word of approval to the essay you have just listened to, and when it has been re-read by teachers of operative dentistry and a syllabus made, it will be found to cover very thoroughly every subject properly belonging to that chair.

In those institutions where a text book on dental anatomy is not used, a series of lectures on Dental Anatomy would come in logical order before "cavity nomenclature." It has been my privilege to teach this subject to the students of the first year, thereby giving me an early opportunity of becoming acquainted with the class and thoroughly grounding them in the nomenclature which is to be used in the lecture room, and technic laboratories, of the second and third year.

The essayist's plan of arranging the subject of the course in the order of the "operation in the mouth" seems to me both wise and sound. It affords both student and teacher, at any time in the session an opportunity to reflect upon and digest the work already gone over, and permit the introduction of outside subjects, without breaking the continuity of the course, so naturally does the subject already considered suggest that which is to follow.

I feel that when I have endorsed the idea, I have really endorsed the paper as a whole and have left little to be said, since there is nothing to take exception to. We are to be congratulated, as well as the essayist. In my work I have always added after the removal of calculus from the teeth and treatment of the gums, a lecture on tooth powders and mouth washes.

I most heartily approve the declaration of the essayist, that the aim of all college teaching should be the "development of individual thinking and reasoning." Dogmatic teaching is therefore to be avoided. We should rather appeal to the intellect of the student than his memory. If you will pardon a personal allusion, I will speak of one other point in the paper, I have always felt the need of notes referred to, and while there can be no debate of the proposition laid down that they should be few and brief, that the lecturer should command the eyes of his students, if he would reach their souls and stir their enthusiasm, a full list of properly arranged topics will frequently enable a speaker to present in logical sequence a subject, without which, he would say but little worth a student's remembering. Nothing tires a class so quickly as a teacher reading from his note or any other book. It is fatal even to have to consult an authority before a class, in fact there should be no book taken into the lecture room to be consulted. It is much better to admit ignorance than to be detected in a preten-

sion. Candor, frankness, simplicity, these are the attributes which should characterize the teacher's attitude toward the student. High sounding technicalities are cloaks for ignorance. The essay under discussion is a fine example of the fact, that a man with a message needs no high sounding phraseology or ambiguous terms.

DR. H. L. AMBLER, Cleveland:

The good sensible essay to which we have just listened, might be termed the philosophy of teaching operative dentistry, because it proposes the application of philosophical principles to the process of teaching for philosophy does not necessarily deal with another world, but with present facts, and they are what the teacher encounters at every lecture and demonstration, and "he must take his bearing from the fixed stars, and not from the shifting scenes and lights of the lower atmosphere."

"The philosophy of teaching is the explanation of the teaching process by means of universal law. By it the separate acts are brought not only into unity among themselves, but into the unity of the complete system of growth."

There is some science in teaching, but we feel that there is a great deal of art, and from what the essayist has written we think he has fully exemplified this fact. We do not go beyond the bounds laid down by the essayist, when we refer to what a teacher should be. The born teacher has tact and personal insight which he brings to bear in every act of teaching, and he knows that great gain is made by planning his work, universal law guides his hand and inspires his heart.

The essayist has shown that his teaching is a process consisting of a series of well defined steps, which he takes to bring about the much desired end, and all good teaching has these organic elements. A knowledge of the results of previous methods in teaching is necessary for the conception of useful ideas, and for the system of carrying these into effect. Strictly speaking, teaching is a mental process, but a great deal of dental teaching combines the mental with the mechanical process, and some go so far as to claim that the diagram method, model method, and laboratory method are the vital ones.

That the order of presentation of any subject should be carried from the fundamentals to minute details, as the essayist proposes, is certainly the proper method, and thus it is well for example, in presenting filling materials to a class of students to begin with the simplest and easiest understood and manipulated, viz.: gutta-percha, cement, amalgam, tin, and gold; treating of their physical and, to some extent, of their chemical properties.

In operative dentistry a large portion of the teaching is didactic, but we believe any lecturer will find the need of at least partially demonstrating some of his lectures, so as to be sure that the class understands him; a large part of the remainder being left for the chair of operative technics and the demonstrators in the operatory. After lectures and demonstrations on a given subject have been completed, there should be a sufficient number of quizzes held, so as to be sure that the student comprehends all of the main points presented, and to correct all false impressions, and the student will often remark, that the quiz was of as much value to him as any portion of the work.

If demonstrators have been taught in your own college, they will be familiar with your way and try to apply it, thus saving time and perplexity; it is much better for a student to know one good way of doing a certain thing than to have faint ideas about two or three ways of doing the same thing.

It has been said of the Englishman in general, that he is nothing if not systematic. If we could truly make this apply to all dental teaching, then it would be a step in advance. The courses in different colleges are largely the same, but even if a teacher does overlap the work of some other chair, it does no harm provided they are in agreement, because there are many things that a student needs to be told about more than once. What one chair does not teach another should, and this can be determined by the teachers going over together a list of the subjects they think properly belong to them, and at the same time considering the extent of detail each one cares to teach.

We observe that the essayist does not rely entirely upon didactic teaching, and here we agree with him, and have often called for some member of the class to act as a subject for demonstration, for students generally prefer to see a thing done, rather than

to hear it talked about, and if they remember anything, it is what they see.

The manner of studying is of as much importance, as how we study and what we study. A student should be taught to remember principles, and not phraseology, and then there will not be a struggle at quiz time to recall some forms of words: this is one objection which has been brought against printed questions and answers.

It would redound to the advantage of both operator and patient, if more instruction was given students in oral hygiene, the teaching of which should include the care of bridges, and all prosthetic work, and this naturally comes to the chair of operative dentistry, unless there is a special lecturer on oral hygiene, which some colleges have.

In a recent newspaper we saw a dentist's card which read, "Dr. B——, Prophylactic Dentistry." Was he not aiming in the right direction?

The essayist makes a slight reference to ethics; we believe that subject should be taught by the chair of operative dentistry, if there is not a special lecturer, as a few schools are fortunate enough to have, but the matter should be well exemplified by all the teachers, and referred to whenever occasion permits.

Porcelain inlay operations may or may not be considered by the chair of operative dentistry, as agreed upon by this chair and the one of prosthetic dentistry, either will answer, only so the student obtains the necessary instruction.

Erosion, abrasion, and we would add atrophy, all to be treated from an operative standpoint, should be included in the chair of operative dentistry.

If there is not a special lecturer on dental history, we think a few lectures and quizzes—not less than five or ten—should be devoted to it by the chair of operative dentistry in every college, thus adding dignity and respect to our calling. No other profession would consider such a proposal as not to teach their students the history of their specialty, and they often add collateral history. Doctor Brophy in his address at Stockholm said, "The leaders in educational work, both general and professional—excepting professors in dental colleges—have but a meager knowledge of what

dentistry is, and what the varied and difficult duties of the dental practitioner are, while many people of culture, people well informed on almost all subjects, have only the most crude ideas of dentistry and dental practice." This being the case it seems highly important that we should instruct the student in history so that we can help educate the public in this respect.

Any lecturer is liable to make an entire omission, or to misplace a part of his subject if he does not use note headings; it is better to use them and thus place a subject before the class just right the first time. It is not easy to undo mistakes; the first statement made is the one that the student is most liable to remember, it is like being introduced to a person who is incorrectly named to you, and afterwards you learn his real name, but you never see him without calling to mind his incorrect name. Mistakes may not ruin the teacher, but they injure the student. Ignorance of the teacher is not a valid excuse, because the fact of his accepting the position implies a pretension to the proper skill and learning.

Teachers must originate and guide their classes; they should be men who stand in the front rank of their specialties as scholars, thinkers, and investigators, and be thoroughly versed in its literature, and of broad mind to enable them to see the relation of their specialty to the entire body of science.

There is a degree of natural talent, of mental power, which all consider desirable in a teacher, and surely he should have an earnest desire to make himself useful in the highest degree to those whom he teaches.

Every teacher who occupies a chair should be so imbued with the importance of his own work, that he thinks all other chairs are of secondary importance; to such men as these we are indebted for very much of our progress, because they think, reason, and invent along their special line, and they talk about the good things they know, and they push them along to success. Given a faculty composed of such strenuous men, they will constitute the very best faculty a dental school can possibly possess, and they will attract and impress students as no half-hearted men can; their highest reward is an approving conscience and the satisfaction of bringing their pupils up to the highest attainments. We believe, as a rule, that students will pay attention to the chair of operative

dentistry better than any other chair, for the average senior cannot see anything but a gold filling, and it is about the height of his ambition to produce a perfect one.

Immediate results are not always the best; it takes time to impress a student, and more time to produce a good dentist. Great advancement has been made in ways and means of teaching, but perfection has not appeared. The method which the essayist has given us is systematic, cumulative, and brings a proper and natural sequence which makes it very interesting to the student. We might say that the accomplishments of a lifetime have been put in an hour-glass."

This is an age when the man who thinks and reasons, is the one most likely to succeed, and the public will look for him in all departments of life, and dental schools should do their part in developing these qualities.

Dr. Geo. E. Hunt, Indianapolis, Ind.:

Dr. Ambler stirred me up on the teacher question, and I want to say a word on that subject. I believe that the good teacher in dentistry, or anything else, is the man the boys love. I would not give the snap of my finger for any teacher on any subject whom the students do not like. A teacher should be able to carry his boys with him all the time, no matter whether he is choice in the selection of his infinitives, or whether he indulges in the use of a little slang now and then. When he talks the class should believe every word he says; they should be his, no matter what language he uses to express his thoughts. You know that as a rule the sky-soaring orator is not the man the boys put much faith in, and I don't blame them. Carry your class with you and you will be a success as a teacher.

Dr. W. C. Barrett, Buffalo, N. Y.:

It would appear that Dr. Hunt, judging from his remarks, teaches anatomy, therapeutics, something of materia medica, all of pathology, orthodontia, operative dentistry. and several miscellaneous subjects from his one chair. It seems to me that that is concentrating altogether too much in one little body. I do not know how deep his pond is—as far as I know it is unfathomable—but I should imagine that it would run dry after a while. I cannot con-

ceive that that is the best way for the average man to teach. It cannot be thorough. For my own part I teach pathology, nothing else, and I give about sixty lectures on oral pathology alone without attempting to make any reference to an instrument or its use. It is my good fortune to be connected with the same faculty with which the essayist is connected; we have interchanged ideas on the subject of our mutual duties and we have no clashing whatever, and he gives a thorough course of lectures. I give as thorough a course as I can. He talks about operative dentistry, and I about pathology; and we both have all we can do. I believe that in the early days of teaching in dentistry all of pathology was taught from the chair of operative dentistry; but I am of the opinion that we ought to have gotten beyond that by this time. Pathology should be a chair by itself and not a branch, and a small one at that, of some other chair. There is certainly enough to teach in operative dentistry proper to occupy all the time and attention of one professor, even a man as capable as Dr. Johnson.

I think we should differentiate between the practical part and the theoretical; that is, betwen the practical and theoretical part of operative dentistry. Operative dentistry in its most exclusiveness is the foundation of dental practice, and it certainly should occupy all the time that one man can give to it in one course of lectures. The theoretical is the real pathology, not simply the symptomatology, but a study of the pathologic changes which take place within the tissues as a result of malnutrition. That is not properly a part of the department of operative dentistry and I am glad that Dr. Johnson takes the same view of the subject that I do. He has all he can do to teach operative dentistry, according to the Johnsonian standard, and so will any one else in that department, or in any other if he sticks to the subject in hand.

Dr. H. A. Smith, Cincinnati, O.:

Dr. Johnson has given us a most excellent paper. I came here especially to hear the paper and I am not sorry that I came. I wish now to refer to what Dr. Hunt said of the regard the student should have for the teacher. I would infinitely rather have the respect of the student than his love. I think it is going too far to attempt to have a class love the teacher. If I can get the respect of my class that is all I can hope to get.

As to the point Dr. Barrett made with reference to teaching pathology: I understand Dr. Johnson to say that he taught some pathology. I think he teaches more than Dr. Barrett thinks he does. I do not see how any teacher of operative dentistry can make his subject clear to the student unless he teaches something of the pathology of dental caries for example. I teach special pathology, but the general subject of pathology is remanded to the lecturer on that subject. I think it is a good plan to have the general subject of pathology taught by a special teacher, but let the teacher of operative dentistry talk pretty fully on what is called oral pathology.

With regard to the method of following notes while lecturing: Dr. G. V. Black, who is known to be a superior teacher, told me a number of years ago that for many years he had burned everything behind him each year. He said that he had never kept any notes excepting perhaps, some statistical matter which had caused him a great deal of work. After a time, when you become experienced, it will not require much time to make fresh notes. If you are a constant student of dental literature it will not be hard.

I am surprised that Dr. Hunt could not succeed in the way indicated. A man of his ability and experience should not fail even if he has not his notes before him. I know from my own experience and observation that the man who delivers a lecture with the fewest possible notes is the most effective teacher.

Dr. M. C. Marshall, St. Louis, Mo.:

As a teacher of operative dentistry I was particularly interested in Dr. Johnson's paper, and I was delighted with the syllabus the doctor presented. I go a little farther back than he does. He began with the hygiene of the mouth. I begin with the sterilization of the instruments and the hygiene of the hands of the operator. I want to say also that I cannot agree with Dr. Johnson in the use of one term, and that is the word peridental. I agree with him when he says that the teacher must be saturated with his subject. It is the concentration of thought, born of enthusiasm, that makes us fit teachers; and that is the condition for one's mind to be in to present the subject properly to the student. I tried to use notes once thinking that I too might evade a stroke of paresis, but in referring to them I became entangled somewhat

and as a consequence became so embarrassed that I suffered from a stroke of diaphoresis, which I assure our friend Hunt is infinitely worse than the other.

Dr. G. V. Black, Chicago, Ill.:

Young men, when beginning their work in teaching operative dentistry or anything else, should write out what they are going to say very carefully; study it thoroughly, then make their notes and leave their writing at home. This will give them an opportunity to formulate what they want to say, get the proper words and the proper idea clothed in good language so that when they appear before their class they will make a good impression and gain the confidence of the students. Of course, some men read with such facility that they teach almost as well from the paper as without it. Possibly some men will do better but not for long. Very soon they should throw away their paper and depend entirely upon formulating the thing before they go to the classroom. Certainly notes should be made even by the older men among us; the headings at least.

I certainly should not undertake to teach anatomy in a course of teaching in operative dentistry. That belongs to another chair. The anatomy of the teeth and the various parts of the mouth should be given by the anatomist. Neither should I undertake to teach general pathology. Operative dentistry, as we know it to-day, deals with caries and its treatment, and the pathology of caries stands by itself. Whenever we touch a dental pulp we are into something else.

We divide operative dentistry, as it is generally known, into technical procedures in operative dentistry, pathology of caries and operative dentistry. I begin to teach operative dentistry after the student knows how to fill teeth. The filling of a tooth is a mere mechanical operation, and has nothing to do, except as a mechanical procedure, with the arrest of decay. What we want to teach in operative dentistry is the arrest of decay, the conditions under which it may be stopped there and then, if that is practicable, or what is best to do when that is impracticable. That is operative dentistry. When we come to the removal of pulps, the treatment of the soft tissues in connection with the teeth, the peridental membrane, then we are in another field of pathology.

It is pathology and therapeutics that we are dealing with then, and it is distinct and apart from operative dentistry. It is too much, gentlemen, to attempt to combine these chairs of pathology and operative dentistry. Of course, we may teach as a technical procedure the filling of roots of teeth, and all that; dealing with the subject in the light of mechanical procedures, purely technical, but we must remember that they are only the technical procedures of operative dentistry and not operative dentistry itself. When we come to deal with operative dentistry, we are dealing with conditions and restorative processes, the relief of distress. The technical procedures are simply a means and are taught as mechanical principles. How we shall lay the margin of a filling to gain the best results comes afterward. Here we are dealing with conditions; we are studying the pathology of decay and laying our plans for its arrest; and it is in this higher sense that we should teach operative dentistry.

Dr. D. R. Stubblefield, Nashville, Tenn.:

I wish to commend the paper that I have read and that I have enjoyed hearing read, simply because it occurs to me that it is almost ideal in its singleness of aim. If there is anything in the world that I admire it is that ability to see the object aimed at and to allow nothing extrinsic to deter your attention until you have reached the goal. Dr. Johnson's resume of his methods of teaching is one built upon such a definite purpose; therefore, it is not diffiuclt for me to imagine him carrying these things in his mind. He does not have to hesitate; there is a straight blazed path and when he sets his feet in that, each part suggests that which is to follow. It is logical; it is single; it is definite; it is intelligible. So that, without being a critical man from the teaching standpoint, I must congratulate myself on having heard on exposition of a teacher's method that is ideal to me.

I attempt to do all this in my own work. I first mature my subject at home, and if I find that I cannot succeed in grasping a clearly defined conception of it, I feel that I am uncertain and unreliable, and I never cease until I have it definitely before me. Then I do not want any notes. I have a message; I have a conviction, and it is not difficult to get the thing which carries it and brings you to the end.

With reference to note-taking: I think that the practice of note-taking, especially in the early stages of our teaching, is necessary. It is done merely to keep the untrained mind in the harness, as it were. You must have a message to convey, and to do that these captional headings are sufficient. It is wrong to attempt to pile it all into a manuscript, for if an obliteration of the definite path occurs, then you are off your feet and are in a rather deplorable condition. A manuscript is always a non-conductor between the reader and his audience. But when the manuscript is used only as a captional heading, whether fully written out or not, it becomes a sign-board directing you along the course you are to travel. We must train ourselves in that direction. Commence to make the briefest outline that will carry you along the road, and base it upon a well-defined conception of the object aimed at. Then, and then only, can we hope to succeed as teachers in any department of dentistry.

What Dr. Johnson presented to us to-day is logical, because he imagines himself operating on a tangible subject, and the students recognize his reasoning as well as the wisdom of his remarks, and, of course, they gladly follow him.

Dr. Geo. E. Hunt, Indianapolis, Ind.:

I should be pleased to have either of the three gentlemen who cannot teach operative dentistry come to our college and I will try to do something for them, and yet I have my notes before me. I do not read them, and I said so very distinctly, but I have them to refer to in case of necessity. I rewrite these notes once every two years. I can remember them better when I do that. I would be very glad to hold a party in Indianapolis, and I will give any of the gentlemen a few points in regard to teaching operative dentistry.

Dr. W. E. Grant, Louisville, Ky.:

I want to commend Dr. Johnson's paper very heartily. I have listened to the discussions so far, and from my standpoint it seems to me that the criticism of not covering enough is not justifiable. My observation in looking over the question of operative dentistry, and what the various teachers are trying to cover in that department, is that the average professor of operative dentistry, devotes more time to subjects that are foreign to operative dentistry than

he does to the subject itself. This thing of devoting two or three months to anatomy, and the same amount of time to pathology and only about six weeks to operative dentistry is a great mistake and overlapping too much on other teachers.

DR. J. D. PATTERSON, Kansas City, Mo.:

I cannot appreciate what is the difference between operative dentistry and operative dentistry. A great many seem to be able to appreciate that difference but I am not of that number. So long as the fact remains that in actual practice the great majority of operations are in conjunction with pathological conditions, it is difficult to see just how operative procedures, and operative procedures combined with pathological conditions can be divorced so readily in teaching. It is well to divorce them if that is possible, on account of the time that is necessary to cover them both, but how this can be done is a puzzle to me. Therefore, operative procedures must perforce take into consideration pathological conditions and must be taught together.

I do not believe that in teaching operative procedures the professor should also teach the anatomy of the teeth. It seems to me that this should be taught entirely separate.

What I want to say more particularly is what Dr. Johnson said so well in his admirable paper in regard to the practical demonstration of operative procedures. I am a teacher of pathology, but not like Dr. Barrett who teaches nothing about instrumentation. When it comes to the treatment of pathological conditions, then we should practice instrumentation upon a dummy or upon a student, and it is a method that teaches my students far more than I can didactically. This is especially true when we consider the subject of cleansing of the teeth, and the treatment of conditions arising from calcic deposits. That is something that cannot possibly be taught didactically. I am extremely fortunate to have a set of teeth I picked up in the dissecting room, badly affected with pyorrhœa in its various stages. I had those jaws prepared for my own use and with a student in the chair and the jaws beside me, I proceed with the proper instruments, showing the position of the operator, the exact sweep of the instrument, and the proper instrument to be used.

I have done this because I found after teaching students for two or three years in regard to this important operation of cleaning the teeth in all stages of diseases, that when I go into the infirmary I see the students' utter incapacity, and it is wrong to expect anything else if we teach this most important subject by didactic work alone. It must be demonstrated practically and I have thus taught some men in my school to be expert operators in the treatment of pyorrhœa alveolaris.

Dr Johnson (closing the discussion):

First, I wish to take you back to the title of my paper. It ran something like this: "The systematic arrangement of lectures on operative dentistry." It was not intended to include all the things taught in operative dentistry. Neither did it pretend to draw a line between the different subjects taught in every college. There should be a distinct understanding between the teachers of different chairs so that the subjects may be in perfect harmony. It is impossible to draw a sharp line of distinction between different subjects and apply it to every college. It would not work well. When Dr. Hunt spoke of all the things he taught in his college I said to myself, as I looked over at Dr. Barrett, that Dr. Hunt is evidently not teaching operative dentistry in the same institution in which Dr. Barrett is teaching pathology. And that proved true.

As to writing out lectures: I admit the truth of Dr. Hunt's argument that it is an excellent way of learning a subject, and in my early days of teaching I wrote out all my lectures, but I assure you that after the first lecture I delivered to my class I never attempted to read a lecture afterward. During recent years I have not been writing out the lectures at all.

TO WHAT EXTENT AND IN WHAT MANNER SHOULD DENTAL STUDENTS BE TAUGHT EMBRYOLOGY?

By I. N. Broomell, D.D.S., Philadelphia, Pa.

The manner of teaching this subject to the dental student of the present day should not differ materially from that used in a medical course. It should be confined as much as possible to the human embryo. Perhaps one of the most important considerations in the study of embryology is that of a positive method of determining age, or at least to very nearly approximate this.

Information regarding the early development of the human embryo is somewhat meager and uncertain, but when this process has progressed to such a degree that the common buccal cavity is recognizable, the study of oral and dental embryology may be pursued with considerable certainty. The age of the embryo previous to this time is not therefore a matter of importance, but after this period it should be one of the first considerations. In the human embryo the age may be determined by measurement, by weight, by the appearance of certain well-defined anatomical parts, and by the disappearance of certain transitory membranes and appendages. That the appearance and growth of any organ or region of the body may be fully understood, the student should first become familiar with general embryology from its very inception, this applying with equal force to the dental as well as the medical student. Create a substantial foundation, therefore, by devoting two or three hours to the careful consideration of such subjects as fertilization, segmentation, and the germinal membrane or blastoderm.

The three germ layers of which the blastoderm is made up should be separately and collectively considered, the process of cell multiplication and cell differentiation carefully explained, and following this the derivatives of the germ layers should be taken up and completely mastered before further progress is made. In this connection the hen's egg serves by far the best purpose, as by its use the early stages above referred to, and especially the

blastodermic period, can be most satisfactorily studied and apprehended. Perhaps after this the general subject should be continued in regard to the various foldings which occur, leading to the differentiation of the embryo from the fetal appendages, and the formation of the body wall and digestive tract. The study should then be carried forward to the evolution of the face and mouth or buccal cavity, and it is here that true dental or oral embryology begins. It is not now sufficient to be content with research which instructs students in regard to the teeth alone, but all parts of the oral cavity, its walls, its bony framework and its important glands should have careful consideration. This part of the work should undoubtedly be confined to the human embryo, carefully prepared sections from two or three of these being sufficient to cover the ground for use in class demonstrations, to which it should be confined. Before making sections, or using those which have already been prepared (the latter is the most practical way), the embryonic face should be macroscopically studied. During the second month the maxillary processes and the mandibular arches are advanced to such an extent that their purpose may be easily explained and readily understood, and if additional embryos, say, one at eight weeks and another at twelve weeks, are next examined, the student could not fail to recognize the manner of the formation of the mouth. After thus carefully progressing with the idea of becoming acquainted with the growth of the mouth in general, the special work of dental embryology may be taken up, this process being so similar in all mammalia that it is not required, nor is it possible to employ human embryo for the purpose. It is not possible because to pursue it very many sections are required, in the production of which much more material is needed than could be obtained from the human subjects.

After considerable experimentation, the writer has come to the conclusion that sheep embryo serve the best purpose. They are readily obtainable, the elongated form of the maxilla is especially convenient, and while it is difficult to understand, the cells appear to be somewhat more strongly differentiated in this than in some other of the other lower animals. Unborn lambs can be obtained from the slaughter houses almost for the asking, and by meas-

urement their approximate ages may be arrived at. Valuable as microscopic sections may be in this particular line of work, they are scarcely more so than carefully conducted macroscopic dissections.

Provide each student with one lateral half of a sheep's mandible. Instruct them to remove from this all the soft structures except the mucous membrane and underlying periosteum. Subject this to some hardening solution for twenty-four to thirty-six hours and they are ready for dissection. Do this by making an incision along the base of the bone, cutting entirely through the mucous membrane and periosteum. Continue the work by stripping the bone first from the facial and then from the lingual surface until the margins of the crypts are reached. Up to this point the operation will be simple enough, but the removal of the follicles from their bony encasements will require special and painstaking care. In order to accomplish this, it is imperative that the periosteum be included and lifted in the dissection. By careful manipulation which may include the removal of small portions of the bony cover to the underlying crypts, the periosteum may be detached from this and the follicles removed. This may in turn be dissected, and a macroscopic study of the contents be made. No other procedure will give the students such a clear idea of the sacular stage of tooth development as the foregoing. By this method the student becomes familiar with the relationship which exists between the tooth germs, the surface epithelium, and the surrounding bony structure, and the preparation for section making may next be taken up, and the results more fully understood.

With this part of the work indelibly impressed upon the minds of the students, little is to be gained by making sections in the very early stages of buccal development, especially when this has been covered by the teachers' slides previously prepared. Lambs' heads varying in length from two to seven or eight inches include all of the important stages in the development of the teeth. The work of section making should be begun on the smallest size, and gradually continued until the maximum size is reached, allowing between each stage not more than a half inch in the length

of the mandible. The following technic for the preparation of material is simple, but effectual.

First. Sever the mandible from the rest of the head, and remove all soft tissues excepting the mucous membrane. The smaller bones may be placed in a hardening solution without cutting, but those of larger size should be cut into pieces, say, about one inch in length. These are next hardened by placing them in a mixture of potassium bichromate two parts, sodium phosphate one part, and water one hundred parts (Muller's Fluid). This fluid should be used in large quantities, and renewed at the end of twelve hours, until twenty-four or thirty-six hours have elapsed, according to the thickness of the specimen. Remove them from this and wash in running water for twenty-four hours.

Second. Dehydrate by placing first in 50 per cent alcohol, which is gradually increased to 75 per cent and finally to pure alcohol.

Third. Any tissue that is not to be decalcified should next be placed in cedar oil for about twenty-four hours to make the tissue take up the paraffine or imbedding material. These are next infiltrated by placing in melted paraffine for twelve hours, the bath being changed at the end of this time, and repeated for a like time, after which the final imbedding may be done.

Fourth. Tissues to be decalcified are taken from the dehydrating bath above referred to, and placed in a decalcifying solution, 3 per cent nitric acid, and 70 per cent alcohol. When decalcification is completed they are washed for twenty-four hours in running water, and again dehydrated. Decalcified specimens are in like manner transferred to paraffine bath, after which they are imbedded.

Fifth. They are now ready for section making. A rapidly-moving micratome will give best results in the way of forming ribbons in section making. Sections of these ribbons may be transferred to the glass slide which has previously been prepared, by giving it a thin coat of Miles albumen, to make the section adhere. A few drops of water are placed over them, and the slide held over a clean Bunsen burner a sufficient length of time to make the sections flatten out. At this stage of the work it is

very much better to examine with a low power to see what the sections contain. If they are not such as are desired, they may be discarded, and others placed in position and examined in the same way. The slides are next placed in a moderate oven over night, with sufficient heat only to more firmly attach them to the glass slide without melting the paraffine investment.

Sixth. After removal from the oven, place in xylol to dissolve the paraffine, which will require from five to ten minutes. Take from the xylol, run pure alcohol over the sections, place in a bath of weak iodine and alcohol, gradually change to alcohol with still less iodine, and finally to pure alcohol, the iodine bath removing the crystal of corrosive sublimate. After the paraffine has thus been removed, the specimen must not for a moment become dry.

The most satisfactory staining solution, and at the same time the most easily managed, is that of carmine and picric acid. First place the slide and specimen in the carmine until the tissue is quite red, say, about one-half hour. Remove from this, wash thoroughly with alcohol, and next place in picric acid for a few moments only, then wash again with alcohol, and next cover the specimen with creosote to make it take up the Canada balsam, if this is used as a mounting medium. Pour off the surplus creosote and complete the operation by the addition of balsam and the cover glass.

Many other stains of course may be used, but little additional information is gained by so doing, and it only complicates what would otherwise be a simple operation.

DISCUSSION.

Dr. Whitslar:

The author of this paper indicates that the manner of teaching this subject should not differ materially from that used in a medical college. The difference is in most cases the amount of embryology taught. It is not necessary to develop the whole anatomy in a dental course, but a general idea of the development of the various tissues is worthy of the time and effort. This is particularly true of the epithelial and connective tissue groups, although the nervous and muscular groups are quite necessary to

consider in the relations of the evolution of the teeth, jaws, and face.

At this point I desire to make this general observation, that the teaching of embryology or any subject should be simple and consistent with the advancement of students. It is therefore expedient that we raise the standards of requirements of entrance to colleges so that subjects taught can be elaborated with the assurance that students will comprehend them. The versatility of the teacher, as well as his ingenuity, is often taxed in the presentation of the subject of embryology. The teaching of anatomy to make it interesting depends upon the teacher. Professor Broomell seems, however, to have solved the problem to a great extent, and met the needs of his classes and himself as a teacher. by providing a suitable and admirable text-book. If we refer to the text and illustrations of this book we can easily comprehend the value of the macroscopic study he outlines in his paper. Actual specimens demonstrated to the class in small sections give instruction that is not easily forgotten, and it also leads to a greater interest in microscopic work. While the laboratory work in general histology should precede the study of embryology, it is necessary to remind the students of the early development of the cell, its maturation and fertilization, then especially segmentation. We now elaborate the epiblast, mesoblast, and hypoblast. If these primitive layers and a general conception of their derivatives is fixed firmly, a basis for evolving the tissues of a tooth is established. For instance, we indicate that the enamel of a tooth is a derivative of the epiblast only. The epiblast lines the cavity of the mouth and becomes the Malphighian layer of the mucous membrane and from this the enamel organ is formed, which by means of the microscope and stereopticon is illustrated a wonderful picture. The processes of segmentation are in reality difficult to pursue, especially of the holoblastic type of segmentation, because of the scarcity of natural material, but the meroblastic type is easily studied with the hen's egg. I have often wished that we could spend some time, if the time allowed, to study successively the stages of the primal stages of the developing chick. This could be accomplished with the hen's egg during

incubation. It would tend to advance microscopic work investigation.

Let me say, that I believe there is no such training in our curriculum preparatory to the dental work proper as microscopy. It trains the eye to see, the mind to think connectedly, and the hands to execute. Microscopic work should have a large place in the curriculum.

Now, Professor Broomell has indicated that the study of embryology should deal with the tooth development as well as the structures of the mouth walls. With this development we must remember that while an embryo is in an ordinary sense the vitalized germ before it reaches its distinctive form, in reality the term embryology is employed to cover the anatomy and physiology of the organism during the whole period embraced between the time of impregnation of the ovum and the complete development it attains in the adult. This, you will perceive, is undoubtedly true, especially in regard to the development of the teeth. Therefore, this course of study should include all the factors pertaining to the eruption of the teeth. This follows naturally after calcification of the teeth. Professor Pierce's chart of the calcification and decalcification of the teeth is of great value, and Dr. Broomell's illustrations of individual teeth upon the same subject are fine.

Dr. Broomell has kindly given us his methods of preparation of specimens as well as his enthusiasm, so it is safe to say that every member of this body will carry home the conviction that the course in embryology must have a larger amount of time and consideration given to it in the curriculum.

J. J. Mackenzie, M.B., Toronto, Canada:

Dr. Broomell's presentation of this important subject has interested me exceedingly, and I regret very much that I cannot be present personally to congratulate him upon it.

There is little doubt in the minds of teachers nowadays as to the importance of a knowledge of embryology for the student of dentistry or medicine. It should form the groundwork for the intelligent appreciation of the facts of both minute and gross anatomy, and our understanding of pathological processes will

be the clearer and broader the more we recognize the influence of embryological factors.

Dr. Broomell's position in regard to the necessity of emphasizing the macroscopic side of the teaching I thoroughly agree with: I believe that it is the experience of every teacher of histology and embryology that he insists more and more upon the study of objects with the naked eye and the lowest powers of the microscope, and if every student were made to provide himself with a good, simple pocket lens, or if each microscope box were provided with one as a part of its equipment, it would be found a very useful adjunct in teaching.

I take it that the author of the paper would not advocate the establishment of a course in embryology distinct from the department of microscopic anatomy, and in this I would agree with him; I personally have always found that the best introduction to the study of histology was a few lectures and demonstrations in general embryology, but there is no doubt that these few introductory lectures are not enough to devote to such an important subject, and the practical question which dental teachers have to face is, how much time can be spared from the already somewhat overloaded curriculum? For the solution of this difficulty I do not presume to offer any suggestions. as I feel that that should be left in the hands of those whose duty it is to arrange the whole curriculum of study. We who are engaged in the teaching of the preliminary subjects of the course are apt to find our departments looming too large in the field of our vision, and no doubt in the struggle after a more scientific groundwork of instruction in medicine and dentistry, it was well that this should be so, but now that this object has been attained, our duty is simply to point out the importance of the subject of embryology, and we may safely leave it to the combined good sense of the faculties to see that it receives its just recognition. I am, perhaps, dwelling a little longer than I should on this aspect of the question, but I feel very strongly that in a great many medical schools of this country we have an example of the way in which one subdivision of a subject has been developed to the detriment of the whole subject in the way in which the teaching of bacteriology has tended to crowd the teaching of general pathology.

I should advocate, therefore, the extension of the time devoted to the course in histology so that the embryological instruction could be included in it and possibly include in the course in comparative anatomy a short course in comparative embryology.

To return to the discussion of Dr. Broomell's paper, it seems to me that the question of the importance of age determination is somewhat overestimated by him; aside from its general developmental significance, I should not be inclined to dwell specially upon it.

In regard to his position in insisting upon a thorough study of the development of the face, there can be no two opinions: its bearing upon oral pathology, one might say, is evident on the face of it. In my own teaching of the development of the tooth, I have found Rose's models of the very greatest assistance, and it seems to me if we had the time to allow students to do a little of the "platten modelirung" for themselves, it would emphasize the value of the results of Rose's work for our knowledge of the developing tooth. It is possible that this might be accomplished by demonstrations to the class from good series of human embryos, followed by the distribution of mimeograph reproductions of drawings of the portions of sections to be modeled. By giving to groups of students definite portions of the face to model or definite parts of the mouth cavity, one could engage the whole class in the work. Instead of wax, modeling clay worked to a proper consistency and rolled to a thickness corresponding with the magnification of the drawings could be used.

It is not, perhaps, wise to criticize methods as outlined in such a paper as Dr. Broomell's, because the methods which give the best results in the hands of a given worker are those with which he is most familiar, but I would like to express my preference for the combination of Formol with the Müller's over the pure Müller as a fixative or a combination of sublimate with potassium bichromate, or even the ordinary aqueous 5 per cent to 10 per cent Formol. For distributing individual sections to the class, I prefer celloidin imbedding, since cut sections can be so easily stored, and there is no danger of destruction of the section if they are given to the class to stain and mount.

As a stain I prefer Hæmatoxylin, and in that modification known as Ehrlich's, staining fairly deeply and using the van Giesen method of counterstaining with picric acid and acid fuchsin; this method of staining I feel convinced is by far the best one we have for routine work, either in normal or pathological histology, giving, as it does, such a beautiful differentiation of all the elements of the section; but, as I suggested above, the good workman rises superior to his tools, and we have only to consider the truly wonderful results achieved in the old days of the simple hand razor or double knife to be again reminded that "it is the man behind the gun that does the work."

In closing, I wish again to offer my heartiest congratulations to the author of the paper for the able manner in which he has presented the claims of embryology for a place in the curriculum.

Dr. F. B. Noyes, Chicago:

Mr. President—The first question in my mind is as to the position of this study in the dental curriculum. Certain it is that there is no more difficult study to teach than this. I am of the opinion that the place for the consideration of this subject is not to serve as an introduction to general histology, because in order to appreciate and understand embryology the student must have the ability to recognize the different tissues. The student is in need of all his knowledge of the appearance of the tissues in order to interpret what is presented to him. He needs all the training and microscopic interpretation he can get in his course. For that reason I believe that all the generai histology should be given in the first year; the dental histology in the first part of the second, and embryology at the close of the second year. At that time he has a thorough knowledge of the tissues in general, the teeth in particular, and he is ready to take up a subject which leads him further than any other in the entire dental course. I mean by that that embryology is the broadest, the deepest and most far-reaching study of them all.

Dr. Broomell says that the manner of teaching this subject to dental students at the present time should not differ from that in force in the medical schools. I cannot agree with him in that regard. The physician is more particularly concerned with the

nutritive processes, as we see them in the embryo, than the dentist. The dental student is more especially interested in the manner of development of the individual as a record of the development of the type, and not with the nutritive processes of the embryo. I believe that we should discard all that we do not have to consider particularly in the dental course, such as the origin and growth of the various maternal membranes and other organs and structures which are developed for the nutrition of that parasitic creature during its parasitic stage. We are concerned with the development of the embryo itself and for that reason we can eliminate the most complicating part of the subject, that with which the medical student must be familiar.

The purely technical part of the paper calls for no discussion. So far as I know the course in dental histology in most dental institutions is practically a study of sections of developing teeth. I believe that that is of comparatively little value to the dental student, because in order to interpret them properly he must have a knowledge of general embryology. I take it that it is obviously impossible for the dental student to spend enough time upon embryology to follow the subject through a full course. It can be only an outline, beginning with the segmentation of the ovum and the formation of the various germ layers; then the heart, enteric tract and the other organs.

What, in my judgment, is required is that the instructor be very familiar with the subject; that he be able to eliminate the complications and present in a clear and concise manner the history of development, and I believe that that can be done better in the lecture-room, with demonstrations in chalk, lantern slide and clay, than we could ever hope to do in the laboratory. I would modify that to this extent. If it were possible to obtain sufficient material for the students to carry out the dissections which the essayist has suggested, and the time of the course were unlimited, I would be ready to admit the value of laboratory work.

The proper introduction to the study of embryology is a historical review of the development of our knowledge of the mechanism of cell life.

That opens before the student's mind the whole subject of heredity and transmission. It presents for his consideration an

entirely new field, one that is extremely far-reaching in its effects and results. It leads to the definiteness of embryological development. The fact that the nucleus of the fertilized ovum controls the whole process, explains how it is that the enamel organ develops in the jaw; and the dental pulp develops under it. Not because the enamel organ makes the dental papilla develop, but because the material which controls the development of the dental papilla and the enamel organ cell has been sent there by the mechanism of cell division. That is the first idea which the student must have in the study of embryology; and then we must follow out the successive stages of development.

The best way to learn anything is to study it out for yourself, but at the same time this is also the slowest and most difficult method. I believe that a good teacher who knows his subject can give a clearer idea of development than the class could work out from original material in five times as much time. What the dental student wants is that clear idea of development without being obliged to go through all the work which would be required of him if we are going to make an original investigator out of him.

Just one word in regard to helps to teaching. I believe that there is no help to the teacher of embryology which can compare with the clay. Take a ball of clay and let it represent the ovum; then carry out the idea of segmentation on that ball of clay and you can show exactly how segmentation takes place; then you slowly develop the blastoderm, and from that go on to the modeling of the primitive groove and the primitive streak; the medullary plates; building them up bit by bit. Then take a knife and cut through that clay and project on the wall from lantern slides the cell structure of the blastoderm. In the same manner you may continue the building up of the embryo, showing the formation of the oral cavity, beginning with the development of the neural canal, the development of the brain vesicles; the formation of the face; the failure of union which causes cleft palate and all the other features of special interest to the dentist. It is in line with Dr. MacKenzie's statement that the wax models are of much use to him. In the technical procedures every man will have his own preferences.

Dr. H. B. Tileston, Louisville, Ky.:

I have been so busy filling the duties of the secretaryship that I have not had any opportunity to prepare any discussion on this subject. But, needless to say, I have been very much interested in Dr. Broomell's paper, and I believe that it is deserving of unstinted commendation. Embryology, although we must all admit its importance, has only a minor place in the minds of most dental teachers and also in the curricula of dental colleges. I have looked in vain in the catalogues of many institutions for even a mention of the fact that embryology is taught or that it is considered of sufficient importance to receive a place in the course of study. And, judging from the general exodus to-night, when this subject came up for discussion, I believe I am justified in saying that it is considered something entirely foreign to the teaching of dentistry. It is an interesting study to take up, and it can be made exceedingly interesting to the class by any one who is an investigator. I at one time was a teacher of embryology, although I never made any original investigations, having neither the time nor the inclination to take up this work, as I know that every teacher of embryology should. Of course Dr. Broomell has made a study of this subject, and he is capable of teaching it in a manner which would be entirely impossible to the great majority of practicing dentists. The subject is taught in a very desultory and unsatisfactory manner in most of our colleges. In teaching it I have never been able to follow the subject as closely as if I had been doing original work, but I always did the best I could from what I could gather from the writings and investigations of others.

The course is not mentioned in the curricula of dental colleges unless it is included under the heading of histology, as was suggested by Dr. Noyes. I believe that this subject should have the consideration at the hands of the dental profession that it deserves, and I am sorry that at the present time it has not a definite place on the curriculum.

Dr. G. V. Black, Chicago:

Although I had the pleasure of hearing the paper, yet I unfortunately missed much of the discussion thus far. Embryology

is a subject of vital importance; a subject that we cannot do without; a subject that we cannot teach in full. When I had dissected and examined the human embryo in all its stages, practically, I obtained one of the greatest works on that subject I have ever known, one of the greatest that has ever been written (it was in the German language), and I found 300 pages of closely set small type, nearly a thousand words to the page, which considered the first three days of the development of the embryo of the chick. After I had waded through all that and thought that I comprehended it fairly well, I said to myself, "We can never teach this subject in any dental school." It can only be taught by the specialist in embryology; and yet, shall we for that reason give up teaching something of it? By no means. Pick out those fundamental things, those things which are of real importance to the dentist, and teach them, not only didactically in the lecture-room, but in the laboratory as well. We ought to do the best we can under the circumstances. It is not necessary, nor is it worth our while, to give all there is on the subject of embryology, but let us teach at least those things a knowledge of which is necessary to a proper understanding of the mechanism of life. We should also teach those things which go to make up the formed elements of the tissues and their development; we should teach along the lines of dental embryology. This we can do with profit to the student without going into the whole subject of embryology. There are some things that he should know, and it is for these that the subject of embryology should be included among the subjects embraced in the dental curriculum. It is altogether too important a subject to be omitted entirely, and it should be taught by a man who is thoroughly competent.

Dr. Wm. C. Barrett, Buffalo, N. Y.:

I understand that the subject under discussion is the teaching of dental embryology and not the study of that science. I do not understand that in our dental colleges it is advisable, or even desirable, to take up original investigation, because if we should attempt it we must take the time for it from other studies, which are much more essential to the dental student than is embryology.

I have for a considerable number of years been teaching dental embryology, and I have never cut a section before the class, nor have I ever asked my students to mount one. I teach that which has already been demonstrated and do not believe it essential practically to prove every proposition advanced. They must accept some things for granted.

All life is not from the egg. Parthenogenesis is the development of the asexual life. In Karyokinesis I commence with the fecundation of the ovum, and carry them through its segmentation and gastrulation, the formation of the several blastodermic layers, the progressive metamorphosis that takes place in the development of the embryo, until I finally reach that stage in which we note the appearance of organs. Then I trace the buddings of the various external parts of the body, the formation of the visceral arches and clefts, gradually leading up to the first formation of the so-called primitive dental groove and the dipping down of the various layers for the formation of the dental follicle. I trace the dental follicle through its development, give its history, and by means of the lantern throw upon the screen the prepared sections, illustrating all the various stages of the growth of the dental follicle. All this can be done without giving out a single section. I believe that it is a waste of energy to give the dental student a course in laboratory embryology, for the time at our disposal will permit only the teaching of a general, yet succinct, idea of the whole subject, without going into a detailed study of it.

That we shall rob other studies which are of more importance to the practicing dentist than embryology of some of the time allotted to them, is radically wrong. I am very glad that we have men in our profession who are willing and who can make original investigations in this subject, but that is not for the mere tyro. I do not believe it either advisable or desirable to teach original investigations, nor even to pursue them in the presence of the student; not because it is undesirable knowledge, but because there is not time enough in which to do this work without taking it from other more important studies. The student should not be compelled to do original work in this subject, but he should have the benefit of such work when it is conducted by his teacher.

Dr. Geo. W. Cook, Chicago:

I want to ask a question. In listening to the discussion on this paper, it is apparent that nearly all are agreed that embryology is one of the essential things in our curriculum. Now, I would like to ask those gentlemen who have been teaching embryology and histology, how much time should be devoted to the teaching of those subjects? Of course, the work can be done only by one who is familiar with these subjects and who has classified them for the dental student. While, as Dr. Barrett says, it is not necessary to teach the dental student how to carry on original investigations, yet I believe it is necessary that he should have a working knowledge of the subject if it is of any value to him. Now, just how much time should be devoted to these studies, and would they crowd the other studies in the curriculum?

Dr. Wm. C. Barrett, Buffalo, N. Y.:

A considerable portion of that which has been sketched out here, and which I have heard mentioned as the study of dental embryology, belongs to embryological histology, and not to the development of the ovum. The organization of the tissues is a part of histology and not embryology, the latter more especially relating to the development of organs.

Dr. F. B. Noyes, Chicago:

My course in embryology occupies about six weeks at the end of the term; one lecture hour and two laboratory hours weekly.

Dr. Fred C. Zapffe, Chicago:

When I was first appointed professor of histology in the dental department of the University of Illinois, I was confronted with the problem of occupying one hour a week with a lecture on histology before a class who had full credit for this subject. The two-year term in histology was then just being inaugurated and it became necessary for me to fill in this time with something which would be of service to the dental student. It occurred to me that a course in embryology would be not only interesting but valuable in pointing out the method of growth and development of the mouth, teeth, jaws and accessory cavities and parts, and also to take up the embryologic causes for the existence of cleft palate,

hare-lip, and other deformities of the oral cavity. To my knowledge no other chair in the college was taking up this work, and I believed at that time that I was a pioneer in teaching embryology to the dental student.

I proceeded to outline my course of work in order to give what was essential to the dentist and yet to hold the interest of the class while I was leading up to that portion of the work. Embryology is essentially a laboratory study, and it is a study of a lifetime and not one of seven or eight months, of one hour a week in the lecture-room or a few hours a week in the laboratory. The peculiar nature of the work, the fact that it is a study in progression, prohibits its study on models, or charts, or even microscopic sections, unless they are serial sections. Again, embryology is a miscroscopic study, and the dental student has neither the time nor the training in microscopic work to go into it to any great extent. Even if it were possible to obtain animal embryos in sufficient quantity to supply each two or three students with a specimen, the rapidity of development in the animal embryo, the vast and important changes that take place in the space of a few hours, militate against the use of animal embryos in the study of embryology; at least, in the class-room or the laboratory of the college. So that when we come to look the ground over we are forced to the conclusion that the effectiveness of a course in embryology is dependent entirely on the ability of the teacher and his wisdom in the choice of such parts as will be of value to the future dentist.

The teacher of embryology should of necessity be thoroughly versed in histology, pathology and bacteriology, so that he can dwell with sufficient emphasis on the relative importance of each stage in the development of a tissue or organ. His knowledge of embryology should be in consonance with his training in the other branches. And, withal, he must avoid overwhelming the student with a mass of facts which take the form of a meaningless jumble. The teacher of embryology should also have some imaginative power; he must be able to depict with the pencil or chalk what he is describing in words; he must have clearly outlined in his own mind just every step of the development of the embryo; what precedes and what follows, so that he can give the

student clear and concise information. Judging from the remarks of the preceding speakers, we all appreciate the difficulty of teaching embryology when it is given at the same time with other work which naturally distracts the mind of the student. A course in embryology, to be complete, should be taken up by itself, followed continuously and thoroughly. Inasmuch as this cannot be done in the dental school, nor in the medical, we must search for the best we can do.

As I am a medical man and not a dentist, I was somewhat at a loss at first to choose just what would be of most service to the dental student. But I managed to get started, and one thing naturally followed another. I devote the last four months, or nearly so, of the junior year, to the teaching of embryology. I give a lecture course, one hour a week, for fourteen weeks. I begin with the fertilization of the ovum and continue with its segmentation, the development of the blastodermic layers, the neural canal, after the formation of the primitive streak and groove. I do not go into the detail of the formation of the genito-urinary nor the respiratory or gastro-intestinal tracts, except in so far as would pertain to the head and neck. I put in all my time on the consideration of the development of the various parts and structures of the head and neck, and especially the oral cavity and its parts and accessory cavities; giving this portion in full with the view of impressing firmly on the mind of the student the reason for malformations. I can complete this course in just fourteen solid lecture hours, excluding the quizzes, and many times I fail to hear the bell and talk more than an hour.

As accessories to teaching this work, I use my hands, my imagination and a good deal of chalk. I draw everything as I describe it; representing it from every side and in all its phases. so that the student cannot but follow me. I use colored crayons and spare no effort to make the work clear. In this way I can follow out the successive stages of growth in one drawing, and I am firmly convinced that my students get more out of it in that way than they would from charts, models, or even a laboratory course. Clay is also an excellent adjunct, but I fear that the students become more interested in the manipulation of the clay than in what you are trying to represent.

HOW MUCH, HOW AND WHEN THE DENTAL STUDENT SHOULD STUDY ANATOMY.

By Leonard C. Borland, M.D., L.P., Chicago, Ill.

The question of "how much" anatomy the student of the dental profession should have taught him seems to be one that has agitated the minds of both the student and the teacher ever since I have been teaching this branch, for the past twelve years. In fact it seems to the author that the most important question for any instructor to decide is "how much" of his subject those under his tuition should have taught them. One cannot accept one's own conclusions as to the amount necessary, with justice to the student, without having first placed them upon the tribunal of the judgment of all other teachers of the same subject; next, all the other teachers connected with the same institution in the other departments, and, finally, must take into consideration the *ultimate needs* of the student himself. From investigation it would appear that there is the widest difference of opinion upon this subject. Many of the teachers in the other scientific and practical branches of dentistry have not the slightest conception of the amount of scientific teaching used as the foundation in medical colleges. Nor do they in many instances even know the amount of these branches taught in their own institution. With a view of obtaining information upon the question of "how much" anatomy should be taught from which to form a composite opinion, the writer has placed himself in communication with fifty institutions in the United States teaching dentistry. As a result of the first inquiry only seventeen replies were obtained. A second and a third communication were sent out, with a final result of receiving replies from thirty-nine of the fifty institutions. The field covered, the manner of teaching, and the time spent were so variable that it was impossible to compile accurate statistics, although a great deal of valuable information was thus obtained from which it is possible to draw some deductions. They have been carefully preserved for reference and will be published verbatim should the society elect. In addition to the consultation of our own schools in regard to the matter in hand,

we have also consulted some of the most prominent teachers of the three professions, to wit: medicine, law and theology, in regard to it. Further, members of the commercial pursuits were asked. To sum up briefly, it seems to be the generally accepted opinion that the dentist should cover the entire field of the fundamental scientific branches in a general way, with special attention to the parts in and about his future field of operation. If the position is tenable that the doctor of dental surgery is a member of the medical profession, and his specialty the structures of the mouth, and that he is of the same professional standing as the doctor of medicine who is a specialist upon the eye, heart or skin, then it seems apparent that the medical specialist upon the eye, etc., is taught a great deal of the unnecessary fundamental, scientific branches of medicine. On the other hand, the dentist as compared with him does not receive nearly the same amount of scientific foundational knowledge. That is to say, that the specialist in medicine upon the eye or ear has certainly received a large amount of unnecessary, impractical and useless training upon the anatomy of parts remote from the field of his work, as well as all the other branches of medicine. It is obvious, also, that the student of dentistry, having made the selection of his specialty at the beginning, is in a position to cut out all this extraneous teaching and confine himself to that portion of scientific, fundamental study which will best fit him for his future work. To substantiate the conclusions before mentioned that a student should study the anatomy of the entire body in a general way I beg to put forth the following reasons: First, from a medical standpoint, there is no line of demarcation separating the oral cavity and its contents from the rest of the body. It is but a part of the entire organism and whatever influences any part of it will necessarily be expressed in the mouth and teeth. The abdominal contents must be included because they contain the alimentary tract, of which the mouth is the beginning. Diseases in other parts of that tract are often expressed in the mouth and teeth. Maladies begun in the mouth or teeth are transmitted and expressed in other parts of the system. The blood vessels which supply the mouth and the blood therein contained are but transitory in the pulp of the teeth and in the floor of the mouth. The corpuscle in the inferior dental

artery can in sixteen seconds be in the plantar artery of the foot. A capsule filled with potassium iodide, covered with a coating only soluble in the stomach, where, the salt being liberated, will pass through the walls of the stomach, be taken up by the blood current, pass to the parotid gland, the salt selected out and secreted, passes into the mouth with the saliva. The starch test will show the presence in the saliva of iodine in forty minutes after being swallowed.

Carbolic acid injected into the gingival margin can be found present in the form of salicyluric acid in the urine in from forty to seventy-five minutes by Sicver's ferric-chloride test. The nervous system of the teeth may, by reflex action, produce pain in the eyes, stomach, ears, or remote parts. Disturbances in other parts may produce pain in the mouth, or disturbances in the teeth. Impairment may be due to pathological conditions in the mouth or the teeth, or vice versa. Phlegmonous inflammation may extend from the temporal-maxillary lingual or facial veins to the internal jugular, thence to all parts of the body. General systemic diseases, as syphilis, tuberculosis, anthrax or malaria, etc., find their point of invasion in this region and transmission to other parts most remote, or, having been received in other parts, find expression in this part. Animals fed alternate months upon arsenic and mercury show a disposition of the chemicals in corresponding concentric rings in the long bones, which I presume is also true of their deposition on the teeth in a similar manner. Reasoning upon these facts the dentist would not be in a position to perform his full duty by his patient were he not able to recognize these conditions and treat or refer for treatment these lesions to the proper source from which they would find relief.

The administration of arsenic, carbolic acid or cocaine, anesthesia with ether or chloroform renders it imperative that he should know enough of physical diagnosis to ascertain that the condition of the heart is normal. I think that this knowledge is possible without rendering it necessary for him to go deeply into the differential diagnosis of the different heart lesions. That is to say, he should know the normal position and sounds of the heart, but need not know the difference between hyperthophy and dilatation, nor which one of the valves is affected. I believe the time is rap-

idly approaching when the dentist will be held responsible by the public should any untoward results take place after the administration of a local or general anesthetic, or the use of any of the toxic drugs, if it should be proven upon investigation that the patient had a pathological lesion that could have been recognized by an intelligent physical examination or an examination of the urine. Therefore, it is necessary for him to study the whole body in anatomy and dissection that he may distinguish the normal from the abnormal.

There seems to be an impression in the dental profession that the student of dentistry is spending far too much time in the study of anatomy, and far more than the medical student. In answer to this I beg to state that during the freshman year the medical student spends an average of 85 per cent of his time on the four fundamental studies of anatomy, physiology, chemistry, materia medica and therapeutics in comparison to only 30 per cent, the maximum time spent in the first year in our institutions, thus leaving a balance of 45 per cent to be devoted to his special study of dentistry.

As an additional argument for covering the entire field of anatomy in a general way, we may use a well-known practice in commerce, to wit: that of having an employe, who is to take charge of any special department in a factory or large commercial house, first to spend a short time in all of the various departments of that institution before entering upon a special field which he is to occupy in time. We might also cite the case of our brother profession, the law, wherein the young lawyer is required to get a good general knowledge of all branches of the profession before he takes unto himself a specialty. The fact that the profession of dentistry began as a trade and was practiced as such originally is no reason that certain members of the medical profession should insist that it must always remain so. Surgery, in ancient times, was not a part of the regular profession of medicine, but was relegated to quacks and charlatans for centuries, until its final development into a science entitled it to a position as a specialty of medicine. History repeats itself to-day in regard to the dental profession.

Is it not right to assume that *any art* having placed under it a sufficient scientific foundation to meet all the possible needs of that calling is entitled to a professional standing? Furthermore, is not

it the right of the dentist to designate himself as "doctor" of dentistry, and be recognized as such by the public, based upon his knowledge of the scientific, fundamental branches of medicine, i. e., anatomy, physiology, chemistry, therapeutics and materia medica? Surely the cognomen "doctor" is not granted for expert mechanical ability.

It is based upon a knowledge of the science and not upon competency in the arts.

In Germany the profession of dentistry is divided into, first, "Zahn Arzt," or, literally translated, "tooth doctor," meaning a physician whose specialty is the teeth and the mouth. He has acquired the title of "doctor of medicine," and in addition spent the required time to become a specialist upon the teeth and mouth. It must, however, be noticed that, owing to the selective method which is pursued at the German university, if he has decided upon dentistry at the beginning of his course of study, he can select those studies which will be of the greatest benefit to him and only cover the others in a general way; *but he must cover them all.* Another class of graduates from technical schools receive their credentials as "Zahn Technicher," literally translated "tooth mechanic." Those holding the diploma of "Zahn Arzt" have naturally a true professional standing, and are permitted to use any drug or perform every operation allowed to any member of the medical profession. Those holding the latter are not permitted to use the term "doctor," nor any other professional title. In conclusion of this part of the subject I permit myself to draw the following conclusions: That the dental student should study and recite the entire human anatomy in a general way, with a special amount of time and study devoted to the mouth, antrum, pharynx, palate, nasal cavity, tongue, neck, brain, thoracic and abdominal cavity, upper extremity, lower extremity, genital and generative organs, gradually reducing the thoroughness of his studies on each of the parts in the order in which I have mentioned. It will be noticed that many of the departments of general anatomy have been left out as unnecessary to the dental student. For instance, perineum, articulation except the tempro-maxillary. Second conclusion, that it is very imperative that the institutions teaching the subject of anatomy to dental students

should arrive at a uniform understanding as to how many hours of lectures, recitations and dissections shall be spent during the first, second and third years of their course of study, and that, having arrived at this conclusion, they shall demand from other departments of medicine (i. e., medical colleges) the standing which this will entitle them to. In medical colleges of the highest standing the time spent in the dissecting room is 240 hours: 60 hours upon the head and neck, 60 hours upon the arm and upper extremities and thoracic cavity, 60 hours upon the abdominal cavity, and 60 hours upon the perineum and lower extremity. If any dental institution is spending, for example, 150 hours in what the medical college is spending 240, then we should receive fifteen twenty-fourths of full credit in that department, and that upon the completion of the balance of ninety hours' work, we are entitled, and not before, to full standing in this department by such of our students as wish to enter the medical college. As is now the case the institutions teaching dentistry are unjustly in many instances asking for full credit in anatomy; and, on the other hand, the medical colleges are refusing to give any credit at all. All this might be avoided by reaching and publishing a uniform standard.

In this connection I cannot do better than to quote the words of the president of the International Commission of Education, Dr. Truman W. Brophy, in an address delivered by him before that body in Stockholm at their last meeting: "A mechanical training of the best kind is essential to the dentist and must form the basis of his future work. I would, therefore, strongly urge you not to imitate the education of the medical student, but to continue on the lines which will train a dentist for his own profession from first to last, and to have a single purpose in view, and to endeavor to obtain a definite result. Do not try to make a medical man a dentist, but let a dentist start and finish as such.

"Can this education be carried on side by side with that of the medical man, is the question of practical importance. I would unhesitatingly answer, No. The anatomist may train either, but he cannot train both together without giving one much more than he requires and not paying enough attention to the other."

Dr. Brophy, in another part of his paper, comments upon the definition of dentistry in the Ninth Revised Edition of the Encyclopedia Britannica as follows: "A special department of medical science embracing the structure, function and therapeutics of the mouth and its continued organs, together with their surgical and prosthetic treatment."

He says: "The above definition is, no doubt, as complete as any yet formulated and published in the English language. It by no means, however, covers the subject, nor conveys to the mind the full scope of the duties of a dental practitioner. Dentistry requires a broader definition than that. Strictly speaking, medical science constitutes but a small part of the modern dental curriculum."

From the foregoing it seems evident that the graduate does not get too much anatomy. Indeed, in spite of considering the immense amount of technique he must compass, the writer is of the opinion that he does not get enough general regional anatomy in dental schools where they maintain a separate dissection room. On the other hand, in dental departments of universities where they receive their instruction in common with medical students it would appear that their course of study is too exacting upon parts far removed from the oral cavity, with no special work upon the palate, antrum, nares, tongue, pharynx, etc.

The generally accepted meaning of the word "professional" among the laity, aside from the dictionary meaning, is one who has taken a thorough course of study and training, fitting him for all of the possible exigencies of that calling, based upon all the sciences having any possible bearing or relation to it, by an institution legally chartered by the government for that specific purpose. That dentistry is worthy of a professional standing, according to the foregoing standard, is not for a moment doubted by anyone who is familiar with the dental curriculum.

As to how the dentist should study anatomy, taking into consideration the fact of the immense amount of technical and special education that he must receive, and that his time is, therefore, exceedingly limited in which he must get his scientific foundation; it is, therefore, necessary to use every possible known means of facilitating his study.

The object of the teacher of anatomy in a dental college should be to give the student the largest amount of the most practical knowledge with the least expenditure of energy and time on the part of the pupil. It has, therefore, been my chief aim in the twelve years that I have been engaged in this work to use all of the known means, and to endeavor to find newer, better methods of teaching anatomy. With that end in view I first advocated the modeling of bones, muscles, arteries and nerves as a means of teaching, and carried it into practice ten years ago.

At the time I did this I was not aware, nor am I yet aware, that this method had been used previously.

HOW TO STUDY ANATOMY.

Didactic or lecturing upon descriptive anatomy is a waste of time as a general thing, and is being gradually done away with. The only thing that the lecturer on anatomy impresses his hearers with is the fact that it has been possible for him to have learned and repeated it, and also to teach the pronunciation of words. The bringing of a cadaver before the class is almost of no value to any larger number than can come near enough to see the structures that have been dissected, i. e., the distance at which one can read fine print.

Didactic teaching on any subject is only of value where it is necessary to show the manner in which conclusions are reached or comparisons made, or the giving of general directions as to methods to be pursued immediately, i. e., to teach the student how to study, what to learn, how to reason and how to draw conclusions. The taking of notes by the student is to a large extent a waste of time, for few can write and listen at the same time. The notes printed in the text book are better than any that he can take. Millions of reams of notes have been scribbled which I am sure are never again read.

The recitation method is more valuable, but it also has the disadvantage that while one student may recite the rest of the class may be dreaming about something else. Its main value is to ascertain that the student knows the subject that has been assigned in the lesson. The method of teaching par excellence is the manual or kindergarten method, in which all students are doing the same

thing at the same time, to accomplish which each must know the subject and keep his mind on it all the time. In this method all the avenues of gaining knowledge are in use, viz.: touch, hearing, sight and comparison.

Taking into consideration the foregoing facts, I have endeavored to devise a system of teaching for the most difficult of all technical subjects, anatomy. The method is described as follows:

Osteology is taught by giving each member of the class the bone under consideration, together with two pounds of artist's modeling compound, obtainable at any artist's material supply house for about fifteen cents a pound, or common clay, such as is used in the manufacture of bricks. If used in the class room, the dough-moulding board of the housewife (cost about twelve cents each), upon which may be held Gray's anatomy, bone and compound while the student models; or in dental colleges the prosthetic laboratory room benches may be brought into requisition. The instructor may pass behind the student while modeling, and, as soon as modeled correctly, hear his recitation upon the same directly from the bone and the model. By returning this bone the next one is given him, and so on. I used this and advocated it as a means of class teaching in 1892. It is now in use in many of the larger universities throughout the United States. I would be pleased to hear if this method has been used before I devised it.

Myology is best taught by having the student model the muscles under consideration upon a skeleton, stiffly wired together for the purpose, as shown in my exhibit No. 1.

The modeling compound I devised for the purpose and perfected, after trying over 200 substances, which would meet with the twelve necessary requisites: 1, easily obtainable; 2, cheap; 3, of a consistency of muscle; 4, plastic; 5, color; 6, non-decomposible; 7, would not "wilt"; 8, would gradually set or become hard; 9, would adhere at the point of attachment and insertion, but not adhere to the other muscle; 10, not soil hands; 11, tenacious, so as to be drawn out; 12, not crumble. The formula for the modeling compound is: To thirteen ounces of water add one teaspoonful of carbolic acid, bring to a boil; ten grains of carmine, and gradu-

ally stir in one pound of rye flour; when mixed remove from the fire and knead in ten drops of oil of cloves.

Arteries, veins and nerves may be added to this model by means of No. 20 telephone wire in red, blue and yellow colors, obtainable at electric supply houses.

Ligaments may be modeled perfectly by dipping absorbent cotton in glue and pasting them on the bones.

The muscle-modeling compound forms an excellent substance for modeling the brain, by which it is possible to give a better idea of the relations of the various parts of the brain than by any other means I have ever tried.

After having pursued the foregoing methods the student is ready to begin the actual dissections of the human body. Owing to the difficulty of obtaining material in many locations, some colleges are obliged to dispense with the dissections of the human body. In that case some of the lower animals may be used to great advantage, as the dog, cat and pig, or the modeling method described may be used.

DISSECTING.

It is of advantage to apportion out the work of dissection into a definite number of regions or parts to be dissected simultaneously by the largest number of students possible. In this manner they will have the advantage of seeing many times the structure under dissection. It is also desirable to have each make a drawing of the parts to be dissected before entering the room. I have prepared a set of thirty outlines, embracing the entire human body, in which the student may fill in the muscles with pink, color the arteries red, veins blue and nerves yellow, with either water color or pencil or colored crayon.

As far as possible a dotted enclosure is left upon each structure, wherein the student is to fill in the name thereof. Drawings of each region occupy the student's time from one to four hours each. Nearly as much knowledge can be gained by filling in and coloring one of these outlines, which only occupies his time for fifteen to thirty minutes, as by making an entire drawing. The portioning out of the day's work and giving a list of the structures to be found in that region, together with some brief instructions and cautions

in its dissection, have also been printed upon the outline accompanying the system. After the student has dissected the region in question he should be quizzed, his paper collected and a mark given averaging his drawing and dissection. This method has the additional advantage of making each student find each structure in the region and cover the entire field. It also does away with the slashing and cutting away of material and throwing it away, which is frequently the case where no attempt is made to check the student's work in detail. It is of satisfaction to the student to know how he stands on each day's work, and is usually a stimulant for him to do good work.

WHEN SHOULD THE STUDENT STUDY ANATOMY?

It is advisable to devote during the first half of the freshman year, or three months, four hours to the recitation and modeling of bones and articulation. During the second half of three months, four hours each week to the modeling and recitation of muscles. During the first three months of the second year, to the modeling of arteries, veins or lymphatics, two hours once each week. During the second half of the second year, or three months, to the brain and nervous system, four hours once each week. The dissecting should be done during the first month of the first, second and third years, four hours each day, five days each week. First year upon the abdominal cavity and lower extremity; second year upon the thoracic cavity and upper extremity; third year, head and neck. During the time the student is engaged in the dissecting room he should not be permitted to do any work in the dental infirmary. It is advisable to have this work gone over as expeditiously as possible, owing to the perishable nature of the material. Also to have it out of the way so that he may have his hands in condition to do work in the mouth for the other five months of the three years.

EXHIBITS.

1—Bones of the vertebral column modeled by freshman class during the first six lessons.

The object of this exhibit is to show the progress made during that short period.

2.—Seventeen hundred drawings of the *ten regions* covered by *175 members* of the *freshmen* during one minor (sixty hours) in dissecting room.

3.—Thirty-six hundred drawings of the twenty regions of the upper extremity, head, neck and thorax and contents, showing drawings of the *special regions* covered by dental students, not usually included in the course of the medical students, were made by 180 members of the junior class during one major (120 hours), in five weeks, twenty-four hours per week. Some students can accomplish this in eighty hours.

These drawings and demonstrations are intended to indicate the *special fields covered*. They are suspended above the dissecting table while the work is being done, and are used for reference by the students. The making of these drawings prior to the doing of the work forces the student to spend some study on the dissecting before entering the room. It relieves the monotony of studying the text and reciting like a parrot, and helps to retain the knowledge and teaches the relations of the parts. Each student receives a mark on the drawing, one on his dissection, and a third on his recitation. These three are averaged together and given as a final mark for this region. It seems to be particularly satisfactory to the student to feel that he has accomplished this much and has it behind him. No final examinations are held for the reasons previously stated.

PRACTICAL DEMONSTRATION NO. 1.

The modeling of bones with plastic compound in the manner pursued by the students, showing compound, modeling tools, board, etc.

PRACTICAL DEMONSTRATION NO. 2.

The modeling of muscles upon the skeleton.

PRACTICAL DEMONSTRATION NO. 3.

Modeling of arteries.

PRACTICAL DEMONSTRATION NO. 4.

Modeling of nerves, brain, etc.

DISCUSSION.

DR. F. D. WEISSE, New York:

The work of Dr. Borland in schematic demonstrative anatomy is most unique and original in all its details, and stamps him as possessing an artistic sense possessed by few, and makes the possessor a born teacher who loves his work and enjoys dispensing the fruits of his gift.

In my experience of all professors in medical and dental institutions, I have met but one other man who possessed the peculiar endowments of Dr. Borland. That was Prof. Gilman Thompson, formerly professor of physiology in the Medical Department of the University of the City of New York; now Professor of Practice of Medicine in the Medical School of Cornell University. His work was in models, illustrating physiological phenomena, which are still extant, they being now obtainable from Ward of Rochester, New York.

I am surprised at the drawing capabilities of Dr. Borland's students, as shown by the reams of drawings exhibited. These drawings are unmistakably great aids to the acquirement and fixation by students of a knowledge of the parts which they are to recognize in their dissections. But I had no conception that our students possessed such an universal ability to draw. I always advise every student to take up free-hand drawing as one of the studies of his preliminary education, because so many students find difficulty in drawing the objects on the slides in the histological and bacteriological courses. The specimens of modeling of bones are revelations of the possibilities of endowing the "Dry Bones" of past anatomy with interest and life. The muscle modeling and attachments and the vessel and nerve inclusions are most ingenious, gross reproductions of nature, well calculated to lead the student to a thorough knowledge of the subject. I would commend most highly his dissecting room methods of having all students dissect the same part at the same time. Also having a drawing of each section suspended over the table while the work is being done. With regard to the value of recitations on anatomy, it is a lifeless—to quote the

essayist's words—"Expenditure of energy and time on the part of the pupil," as compared with results obtained by time spent with other methods. In brief, I have naught but commendation of this method of schematic demonstrative anatomy, and would tender my congratulations to its originator on the possession of a gift which combines the deft of both sculptor and artist. I would especially emphasize the thought of the essayist by repeating it that we may all remember it: "The object of the teacher of anatomy—the same is true of the teacher of any department of the curriculum—should be to give the student the largest amount of the most practical knowledge with the least expenditure of energy and time on the part of the pupil." As the subject of this essay is "Teaching of Dental Anatomy to Dental Students." I think it may interest the representatives of dental institutions and a few teachers of dental anatomy in dental institutions that are present at this meeting, to call attention to how general anatomy is taught the dental student at the New York College of Dentistry.

We have always held with the author of the paper that the dental student should be taught the anatomy of the entire body. We divide the subject between the department of anatomy proper, and the department of physiology. The department of anatomy, developing the regional anatomy, locating all organs, including the viscera; while the department of physiology develops the special anatomy of the viscera, the chair being called "Physiology, Visceral Anatomy, and Histology."

Experience of the past thirty odd years has proven this division of the work as most advantageous to the student in his better acquirement of both the anatomy and physiology of the organs, the anatomy of the organ directly preceding its physiology. This division also affords the professor of anatomy more time to develop the regional relations of the organs of the several subregions of the body. Anatomy must be taught in one of three ways: first, from the cadaver; second, by every possible schematic aid that may be devised, for facilitating the student in finding and recognizing the several parts as he dissects; third, by didactic lectures, with selected sequential reproductions of nature, so enlarged as to be instantly realized by all the auditors

before the lecturer. Much has been said of the uselessness of didactic lecture teaching as compared with dissecting room and laboratory work. Where the question of technic is the knowledge to be acquired, this may be the case in a large degree, but there is a vitality that is imparted in the dispensing of knowledge by the human voice—when it is impelled by a complete knowledge of his subject by the lecturer—and when it is enthused with the magnetism of the enthusiasm of the true teacher,—which commands the attention and makes the minds of the auditors receptive of the subject matter being taught.

It will be a long time before the human voice will be silenced as a medium of imparting knowledge by exclusive laboratory teaching. The appreciation by the organs of hearing should be assisted by the organs of seeing; in grasping the trend of the lecturer's words. Did you ever think that if knowledge is received by hearing alone that each side of the head presents a hearing hole? It too often happens that the knowledge goes in one hole to come out the other; but when knowledge enters by the pupil hole of the eyes, it is more apt to be retained, as there are no holes at the back of the head for it to escape.

Now, I wish to show you the method I have resorted to for over twenty-five years, to illustrate my didactic lectures on anatomy. I must say here that I consider prepared dissections as aids to illustrate didactic lectures as useless for purposes of demonstration to audiences of over ten students. I have to plead guilty to being the author of a book on "Practical Human Anatomy," which is illustrated from my own dissections of the entire body. These dissections are arranged sequentially to display the complete anatomy of a given region. I have had lantern slides made of these illustrations, and one of these is always on the screen as my lecture progresses. My object is to evolve as I progress, a verbal description of the region which appealed to the hearing at the same time that a pictorial verification of the description is demonstrated for the appreciation of the scene. In this way I can effectively impart the knowledge of the subject to auditors by the hundred. After the student has listened to the lectures, the volume of illustrations becomes his text book, which he can study and he can take it to the cadaver,

prepared to recognize what his dissection develops, and thereafter—having found that the illustrations are true reproductions of nature—the volume becomes to him a *vade mecum* which ever reminds him of his dissections. The kindness of your executive committee in obtaining lantern facilities for me, enables me to exhibit to you some of these sequential dissections for illustrating didactic lectures on anatomy, which are within the reach of all lecturers on anatomy and where dissecting materials are not abundant, they can, in a great degree, compensate for it. This I know to be a fact, as for several years the dental institutions of the state of New York could not obtain dissecting material under the anatomy law; and these slides were my only aid in teaching anatomy, and during those years, my students acquired a knowledge of anatomy therewith.

(Here followed exhibition of lantern slides of sequential dissections of face and thoracic subregions.)

Dr. Wm. C. Barrett, Buffalo, N. Y.:

I am not a teacher of anatomy and therefore am not competent to discuss this paper. However, Dr. Borland is my associate in the faculty of the Chicago College of Dental Surgery, I am acquainted with his work and believe that I have cause to congratulate you upon having listened to this very excellent paper, and myself for having him as a co-laborer. I merely wish to verify what he has said.

Dr. A. O. Hunt, Omaha, Neb.:

I will not take up your time for more than a moment as I wish to refer to only one point mentioned in the paper, and that is the use of the blackboard and chalk. I am fully satisfied from experience that the very best of models and charts do not impress upon the mind of the student so clearly and so quickly what you desire to have him know as a thorough and liberal use of the chalk, doing this at the time that you are delivering your lecture. This method has many advantages; the principal one is that while you are working the student's interest is naturally directed to what you are doing. He is bound to follow you in your work. Some will say that only a few men can do this, but

I am inclined to believe that more could if they would only try it. It is not a difficult matter to make an outline drawing: it may not be absolutely correct, but it is sufficient to convey the idea of what you are talking about, clearly, quickly and concisely to the student.

(I wish to offer a motion, if it is in order; Dr. Borland is not a dentist, although a teacher in a dental college; he has come among us, giving us his methods of teaching, and I move that a vote of thanks be extended by this institute to Dr. Borland for his courtesy. Motion was carried.)

Dr. W. H. Whitslar, Cleveland, O.:

The essayist said that the didactic teacher should also teach proper pronunciation. I therefore arise to say that in the pronunciation of the word anatomy, it should be an-at'-o-me and not a-nat'-omy.

TEACHING APPLIED PHYSICS.

By G. V. Black, M.D., D.D.S., Chicago, Ill.

In dentistry there is so much that should be approached by the student from the general standpoint of the phenomena usually classed under the head of physics that it has seemed to me that it would be best to group these into a special course of instruction that should in the main assume the character of laboratory work.

This would be very distinct from the technic courses which I introduced in 1888 which have since had their regular place in dental schools, and have produced excellent results. These courses serve to train both the mind and the fingers in the technical procedures in dentistry, and incidentally give the student a certain practical acquaintance with the physical properties of the materials which he handles. Through this work he learns, in operative technics, the physical forms, or the anatomy of the teeth, their behavior to cutting instruments, gains a special knowledge of the hardness and brittleness of enamel and dentine, gains some knowledge of the properties of steel, and of the forms and uses of steel instruments in dentistry. In prosthetic technics the student gains a similar knowledge of the metals, porcelain, rubber, Plaster of Paris, and other material things that we use together with the technical procedures in that use.

In all of this teaching the principal factors are the technical procedures and the training in finger skill. The teaching of the physical properties of the materials is incidental and such as is derived through the senses by the ordinary handling of the material. In our professional development it is becoming apparent that something more is necessary to properly equip our students to meet the requirements of practice. The question comes as to whether we will be able to develop this, now that we will have a course of four years instead of three. The object of this paper will be to point out the general subject matter of

such a course rather than to attempt now to give the particular forms of the laboratory teaching.

In this course in applied physics it has not been my thought to do much with the general subject of physics as taught in our high schools and colleges. Our students should come to us with at least the outlines of this knowledge, though with our present requirement of only two years in the high school many of our students have but a slight knowledge of it; many, none at all, while the few only are really well prepared. Some of our high schools have well equipped physical laboratories, some are indifferently equipped, and many have no laboratory apparatus whatever. I have studied this matter pretty closely in the credentials of students and the reports from high schools, and find with some chagrin that the high school work, even to graduation, cannot be relied upon as a good preparation for the work in applied physics that we need to install in our dental schools. Our students ought to come to us well grounded in the phenomena of force and motion and the physical relations of the more common material things to these phenomena, but as a body they do not. This is all the more surprising when we consider that the material improvement in our knowledge as a people upon which the great prosperity of the nation is based is principally of the laws of force and motion in their application to material things. For these reasons it is probable that a part of the time of a class in applied physics should be spent rather upon some portions of the general subject as well as upon the application of physics in dentistry.

I should think it especially well to go over the detail (briefly) of electrical phenomena, in their relation to the production of motion (or power) and heat, and the conditions of its use in motion and heat production. This much seems to be demanded by the extensive employment of electricity in dentistry. This should be a laboratory course with sufficient apparatus to display the phenomena very fully and enable each student to develop them himself under proper direction. The course should include wiring, placing fuses, etc., with all necessary precautions for safety, determinations of polarity, voltage, placing of resistance apparatus, etc., and the effects of these in

their relation to heat and motion production under all of the known conditions of the use of electricity in dentistry.

The X-Ray, which has come into such prominent use in orthodontia and oral surgery, should receive its share of study. This, on account of its necessary connection with photography, would for the present take the form largely of demonstration, such as would render students familiar with the general detail of its use, the conditions of its successful use, and the conditions demanding its employment.

The other subjects taken up, while purely of the physical type, and to be dealt with as studies in physics by laboratory methods, would be especially dental subjects applying, if possible, more directly to our daily operations. They would be such as the following, which I will present briefly as questions to be answered by laboratory exercises with the proper physical apparatus, or as studies to be pursued in a similar manner. The necessary physical apparatus or instruments for this work have now been developed in nearly all of its lines, but I have no doubt that with the general adoption of such a course many improvements would quickly follow.

What force can be exerted by the human jaws in closing the teeth? What are its averages, and its variations among healthy normal persons?

What is the average force used in chewing foods, its normal and accidental variations?

What is the average weight endurance, without actual pain, of the peridental membranes of different classes of teeth, as molars, bicuspids, incisors, etc., and what are the relative capabilities of the roots of these several classes of teeth in sustaining crowns and the abutments of bridges? These would be determined with the gnathodynamometer.

What is the apparent necessity of X-Ray pictures for ascertaining the length and strength of roots of teeth upon which abutments of bridges are proposed to be sustained?

What is the average and the ordinary variations of force required in crushing particular articles of food? Determined with the phagodynamometer.

What is the actual strength of a human tooth, incisor, cuspid, bicuspid, or molar, as a whole, to breaking or crushing force, first against steel, against which but a minute area of tooth surface will be engaged, then against annealed brass which will be slightly indented allowing the contact of a greater area, then against lead and the softer metals, or against hard wood? These would be determined with the dynamometer on freshly extracted teeth, or those that had not been allowed to dry.

What is the strength of walls of cavities to breaking stress in conditions in which we find them in practice? (This would be done by selecting and preparing cavities in freshly extracted teeth and then submitting the walls to breaking stress in various forms with one of the dynamometers.)

What is the strength of blocks cut from human dentine (8-100 inch square) and the comparative strength in the different blocks from the same tooth and in the teeth from different persons. This would be more difficult of introduction because of the expense of the necessary machines for cutting the blocks.

What is the strength to crushing or breaking stress of blocks of porcelain especially made for test in definite sizes. This would give the first practice in breaking porcelain under conditions controlling exactness of work and accurate determination of results.

What is the strength of porcelain teeth as mounted as artificial crowns? (Trials of different forms of mounting and different manufactures of teeth.) In this, crowns would be mounted in the technic laboratory for trials in the physical.

These trials would be made with the dynamometer so rigged, or arranged that the tooth might be held at any angle to the line of force to obtain its strength at the different angles of force found in the occlusion and the varying inclinations of the teeth in the mouth. This set of tests tell some wonderful stories of the variations of strength in the various positions and inclinations in which teeth are mounted. Often teeth that will sustain a load of one hundred pounds in one inclination will break at fifteen pounds in another. And with sufficient study of these tests such differences can be predicted with certainty when the relation of the tooth to the line of force is seen.

What is the power of pure hammered gold to sustain stress, taken in blocks of definite size, say one-tenth inch square, or what pressure in pounds will be required to reduce the length 1 per cent, 5 per cent, 10 per cent, etc.?

In what proportion is this power lost in annealing?

What temperature (about) is required in annealing as shown by the softening apparent in dynamometer tests?

(All of this class of tests must be made with the dynamometer with micrometer attachment in which the reading of pounds pressure and amount of condensation are obtained as one operation.)

What is the effect upon the power of gold blocks in sustaining stress of 10 per cent of alloy, of silver, of copper, or of 10 per cent of alloy, of equal parts of silver and copper, etc., or of other metals *ad libitum?*

What is the stress required to bend bars of some definite size of pure hammered gold or platinum? What is the effect of annealing these bars on the stress required to bend them—on the stress required to break them? What is the relation of this stress to the strength of the human bite?

What is the relation of bending or breaking stress to the length of the bars, the size being equal?

What is the effect as to bending or breaking strength of alloying platinum with 5, 10, 15 or 20 per cent of gold or of alloying gold with similar proportions of platinum or with silver, copper, or silver and copper, etc.?

In all cases the tests should be made with hammered or hard rolled bars and with annealed bars. These tests would be made with the dynamometer or with falling weights.

Tests of the fusing temperature (comparative at least) can readily be made in the electric furnace that will develop the physical characters in that direction and give valuable practical instruction regarding the formation of solders. Tests of the *fluidity* of solders of different compositions may readily be made in the electric furnace by comparative rotundity or flattening of globules of definite size brought to degrees of heat between the melting point of the solders and metals to be soldered and allowed to cool on a flat surface. This fluidity has directly to do with the *easy flowing* of the solders.

What is the density or specific gravity of pure hammered gold? What density may be attained in making gold fillings by hand pressure, or by mallet pressure, using steel matrices?

This test of density should be made by weighing in air and in water at a given temperature, and also by measurement and weight and checked up for comparison.

The same gold blocks are then tested for condensing pressures with the dynamometer and the results checked up for comparison. In this experience will show that the force of the blows used, and the character of the resistance (whether the matrix is held upon a solid or a spongy support) used in making the filling, may give a hard filling resembling hammered gold or a soft filling resembling annealed gold with similar differences in their power to carry heavy stress with or without marked yielding. These fillings can now be made in the manudynamometer in which each thrust of the instrument with its force in pounds may be recorded, or in the tuptodynamometer with a similar record of the number of blows and the force of each.

A study of the force of the hand pressure thrust with the pen grasp and with the palm grasp with their variations in different individuals by use of the manudynamometer.

A study of the force of the blows of the mallet and of the condensing power of mallets of different weights with the tuptodynamometer.

A study of the force of blows with weights of ½ oz., 1 oz., 2 ozs., 3 ozs., etc., falling from different measured heights with the falling weight apparatus. This may be done on the tuptodynamometer with polished blocks of boxwood, showing the penetration by comparison with a thrust pressure of a definite measured number of pounds made with the registering dynamometer. This will give evidence of the actual number of pounds contact force in blows delivered as distinguished from foot pounds, or the impulse of the blow. This latter may be more accurately studied by delivering the blows of falling weights and the dynamometer thrusts on blocks of annealed brass with instrument points of definite measured size and measuring the penetration with a micrometer that will work easily and conveniently to the ten-thousandth of an inch.

This study will open up in a definite experimental way the whole question of the contact force of blows in comparison with the foot pound power or impulse producing force. This and the instruments for its development are new, in the combinations used, to the science of mass motion and force and will develop a distinct line of new facts regarding the contact force in mass motion and resistance. This study may be varied in a multitude of ways, giving a wide insight into this very interesting subject. It will, in all of its variations, give a wide divergence between foot pound force, whch is impulse producing, and contact force in pounds weight. The contact force measured in pounds is the condensing force used in condensing gold, not the impulse producing force, or foot pounds. Much of the text of the books on physics may be used in this study.

A study of amalgam alloys.

The formations of amalgam alloys of silver and tin, melting in air, or in the open crucible, melting under fluxes and a study of oxidation and loss. Melting in the closed electric crucible with studies of differences in oxidation and loss.

A good short line of studies may be had by forming alloys of silver and tin in the following proportions: Silver 40, tin 60; silver 50, tin 50; silver 60, tin 40; silver 70, tin 30. For testing the modifying metals, five per cent of the silver may be substituted by an equal weight of copper, zinc, cadmium, gold platinum, aluminum, etc., *ad libitum,* and these combinations will be used in the tests of alloys. Other lines of formulae may be adopted in greater or smaller number, giving such range of study as time will permit.

In this there is accurate practice in weighing metals into the crucible and weighing the ingot, also in taking the specific gravity of the metals before placing in the crucible, finding the mean specific gravity, and then taking the specific gravity of the ingot and noting the condensation in the formation of the alloy. This, if done with sufficient accuracy, becomes an index to the degree of actual alloy formation as distinguished from the mere mingling of metals without actual alloying.

Cutting alloys, annealing cut alloys.

Experimental studies of the proportion of mercury to alloys required to make amalgams with alloys composed of different proportions of silver and tin.

The same experiments repeated with the same alloys after annealing, showing differences in the proportions of mercury required in making amalgams with fresh cut or unannealed and annealed alloys, and the variations in the consistence and physical qualities of the amalgams formed. In this there is also accurate practice in weighing alloys, mercury, and the mass formed, showing also percentage of loss in handling.

Still using the same alloys. Fillings are made in steel tubes using the binocular microscope in testing accuracy in finishing to margins followed by measurement of contraction and expansion during setting and following setting, or until movement ceases, a period of from five to thirty days.

In these tests each experimental filling would be followed with micrometer tests, observation of the movement with the binocular microscope and in companion fillings with specific gravity tests until movement ceased.

Also tests of the results of mixing instead of actual alloying, which give very striking results, are made by weighing one-half the amount of alloy required to make a test filling, and then adding to, and commingling with this an equal part of the fillings of silver and of tin in the exact proportions in which these metals exist in the alloy. This mixture is then treated in every way as the alloy in making an amalgam and carried through all of the tests.

Examination of the stress required to crush fully set amalgam blocks to obtain the comparative strength.

A study of the flow under stationary stress of each amalgam to obtain its power of endurance under stress.

These two studies will be made with small blocks of definite size made from the same alloys used in other tests.

A study of the shrinkage and expansion of oxyphosphate cements by making fillings in steel tubes followed by micrometer measurements and observation with the binocular microscope under varying conditions of mixing. Also when kept dry and when kept wet using various makes of cement.

A study of the penetration of cements by colored fluids which denote the degree of penetration of moisture. These studies give good perceptions of the usefulness, or uselessness, of the various cements for temporary fillings and if followed by chemical experiments displaying their solubility will give a fairly good idea of their probable endurance.

A study of the expansion of Plaster of Paris with a micrometer for its accurate measurement.

Then a study of the warping of plaster under the conditions of its use in taking impressions and making casts.

In this there is a wide range of opportunity for the teacher to display his ingenuity in improvising cheap apparatus that will show to the eye exaggerated warpage and the conditions of its occurrence.

This should be followed with a study of plasters from different sources, together with a study of methods of keeping after calcining, or of the effects of weather upon the plaster and the necessary precautions to maintain the physical properties of plaster in the best condition for our use.

I have now enumerated subjects of study, every one of which is important in dentistry, the reasonably perfect pursuit of which would require the time of the student three hours per day for two years of the dental school course of seven months each year, excluding holidays and the time taken up in examinations. It is at once clear that as schools are at present constituted, or as they will be in the four years' course, this work can be done only in part. Much abridgement would have to be made in any attempt to follow out such a course. For instance, a course in amalgams may be undertaken with several different ideas in view. First, it may be undertaken with the view of that completeness of the study of the metals and their manipulation as will render the student fit to undertake the commercial manufacture of alloys. This would require 288 hours of laboratory work, two-thirds of a year, three hours per day. This is clearly not the dental student's province, and not the work of the dental school as such. A very much shorter course will render the student intelligent as to the physical properties of alloys and the basic principles of their formation and use. This he ought to have as a dentist. This he must have in order to use amalgams in a

manner to develop the highest good in their use. For this a well selected abridged course occupying three hours every other day for six weeks (90 hours) would give a fair degree of instruction. This could be given in sections in which about eight students could be grouped with one set of instruments, with the exception of the cheaper articles, as tubes, matrices, etc., and materially reduce the expense for instruments, while some of the more expensive instruments, as the amalgam micrometer, measuring to ten-thousandths of an inch or to microns in the metric system, would be really used mostly by the demonstrator and one would answer for the entire section. By certain inexpensive modifications the amalgam micrometer becomes the essential instrument for all of the very delicate measurements, and may be used for many purposes in various parts of the course.

A course in the examination of the physical properties of gold similar to that detailed would be a most important part of the work. The importance does not relate so much to the gaining of knowledge that gold has such and such a specific gravity under such and such conditions as in having seen and realized the conditions and having worked them out by exact methods. The simple filling of a matrix with gold and making test of its density is of less value than the study of the particular methods of making the filling, the force used, the perfection of the surfaces against the walls and in angles of the matrix as observed by microscopic examination after removal of the filling. These combined observations tell in shaping the future practice of the student. This is a class of observation the student cannot obtain with present methods of teaching. A very extended course is not so necessary as a very carefully conducted course.

The double bow spring dynamometer with micrometer attachment making measurements at one-thousandth of an inch or to a similar grade in the metric system, as desired, used especially in the gold and amalgam work, is another of the very expensive instruments that may, by cheap arrangement of points and holding apparatus, be made to do duty in all departments where accurate trials of strength or measurements of compression are required.

The *thrust dynamometer*, which I called the phagodynamometer at first because of its special arrangement for testing the force

required in chewing food, is by varying the arrangement of its jaws to different purposes serving a multitude of purposes, and by reason of the great facility of use it at once becomes the instrument for the measurement of force in breaking and bending stress under any conditions in which the measurement of condensation is not a feature of the operation, as for breaking porcelain, porcelain teeth, bending bars of metals, etc., and registering the number of pounds required.

The falling weight apparatus is less extended in its uses, and more nearly confined to uses in the more purely scientific sense, and yet serving to impart very practical lessons. It is particularly essential in the study of the effect of mass motion and the contact resistance in the arrest of motion. When used in conjunction with the tuptodynamometer and the thrust dynamometer for this purpose it becomes one of the essential instruments in measuring accurately the contact force of blows such as are given with the mallet.

In all of this study of mass motion, resistance, contact force or impulse producing force developed by blows, and gaining an insight into the real nature of these it is one of the essential pieces of apparatus.

In the teaching with this instrument much of the subject matter may be drawn from the text books on physics and yet none of these will be found to develop the material facts of the force developed in the contact of mass in motion when meeting with absolute or modified arrest of motion by resistance, as I should wish to display it with this instrument. This, of course, cannot be further discussed in a paper of this character.

The manudynamometer is the most essential instrument in giving the student a correct estimate of the power with which he is able to handle instruments and in pointing out his deficiencies. Practice with this points the way to essential improvement, partly by showing the differences among persons in the development of the muscular power of the hand, partly by the direction this gives to effort, but most important of all it brings the teacher and student to understand each other in the use of terms relating to the use of force and renders teaching along all of these lines more exact and impressive.

The expense of these instruments is a serious drawback to the introduction of such a course, for without them a laboratory course, such as is contemplated, is out of the question. If there were orders for a sufficient number at one time the expense of the instruments could be materially reduced, for the reason that the wholesale manufacture is very much cheaper than making single instruments. The instruments can be conveniently made in sets of about twelve or sixteen of each, but would be still cheaper if fifty or a hundred could be made in a single lot. If made in that way, by the wholesale, they would not be very expensive, for such an order would justify the development of special apparatus for their manufacture.

Supposing the instruments to be made in lots, half dozen each, the cost would be something as follows:

Amalgam micrometer with 50 tubes	$125.00
Double bowspring dynamometer with micrometer attachment	75.00
Thrust dynamometer	50.00
Fixtures accompanying	25.00
Falling weight machine with anvil	45.00
Tuptodynamometer	60.00
Manudynamometer	60.00
Accessories	50.00
Gnathodynamometer	20.00
Binocular Microscope with ¼-inch lense	60.00
Machine for cutting teeth, with electric motor	80.00
Scales and weights and accessories for specific gravity and other work	40.00
Expansion micrometer for Plaster of Paris	50.00
Electrical apparatus	100.00
Crucibles for melting metals, electric	10.00
Total	$850.00

The cost of material per student would be from five to eight dollars, principally for gold and platinum, while more than this might be used. Most of the noble metals, except gold foil, could be sold for about their cost, the expense representing the loss.

In making out the list it has been supposed that certain of the electric motors, electric ovens, electric annealers, etc., in ordinary general use in the school might on occasion be used in the physical laboratory. If we must suppose that all of this be especially purchased the expense would be greater. The X-Ray apparatus has also been left out of this count.

Some of these instruments, and especially the more expensive ones, can be made to serve the whole class, even in the larger schools, but matrixes in which to make experimental fillings, electric crucibles, and many of the less expensive accessory pieces would need to be duplicated so that each would be used by a small section. A binocular microscope would serve a group of six or eight students very well, and as this instrument is used in but a portion of the course it is not impossible that by a skillful handling of the class so that the different small sections would at the individual exercise work at different things, much saving of duplications might be effected.

DISCUSSION.

DR. GEO. H. WILSON, Cleveland, O.:

I am sure that it has given us all a great deal of pleasure to listen to this very excellent paper. I must say, however, that I feel that I am somewhat unprepared to discuss it because it so happened that the copy of the paper was not placed in my hands until after I reached Chicago. We all appreciate that Dr. Black is a very competent man; his shoulders are broad in many ways, and, perhaps, this is not a bad time to hit others over his shoulders at the same time that we hit him. The more valuable the paper, the greater the necessity of placing a copy in the hands of the discussers before the time of the reading of the paper. If the copy is not given you until after you reach the place of meeting, I think you will agree with me that there is not time enough to prepare a discussion which would do justice to both the essayist and his discusser. It is impossible for me to go into an extensive discussion under these circumstances, and yet there are so many points in the paper on which

I wish to touch in passing that I think I can give you enough on the subject without having had any preparation.

So far as most of the paper is concerned, I do not wish to consider it. It speaks for itself. The various appliances which the doctor presented and exhibited also speak for themselves. But there are some principles that underly it all on which I wish to speak. As to the question, whether or not physics should be taught very extensively in our dental colleges, I do not like the term physics at all. It is really a word of modern coinage. Some twenty or thirty or more years ago, when some of us were attending school, we called this particular science "natural philosophy," and I have noticed that there is a disposition to go back to that term again at this time. That term is a vastly better one than "physics"; it conveys more of an idea to our minds; philosophy—the reason for things, of natural things or natural phenomena. Surely there is no one present who would question the usefulness of the study of natural phenomena in dentistry. In fact, we might go so far as to say that in dentistry there are but two subjects which are required for a foundation; one is natural philosophy and the other is physiology. These two studies in themselves form the real foundation of the whole subject of dentistry. If we are going to understand dentistry we must study fundamental principles which are involved and we find these in physics and physiology. All the other studies are developed from these two.

It has been said a number of times during this meeting that the great idea of our dental teaching is to make dentists. That is correct, if we have the correct idea of what a dentist is. We do not understand that when the student goes out from the college he is as perfect a product as he will be when he has been out five or ten years. In order to turn out such a dentist it would be necessary that we place the student at the chair as soon as he enters college and keep him there until he goes out at the end of the third or fourth year, and even then, perhaps, he would be only a moderately good operator. But it seems to me that there is something more than that necessary, and that is for us to lay such a broad foundation for him that he can in time develop into a good operator. I believe that when a man has

been properly taught, and has been given the practice of inserting from a hundred to two hundred gold fillings and such other operative work as is demanded of him, that he has as much practice and experience and training as it is possible to give a student during his three or four years at college. If he has not acquired the knowledge he should have, then he should be required to take a part of his work over; he should not be retained in the regular course of study.

So I say for that reason the mere ability to fill cavities and do other operative work is not the making of a dentist. We want to give him a good, broad, liberal education. How can we do it? First, by enabling him to make use of his knowledge to become a dentist; give him a knowledge of the literature of our profession and enable him to use it correctly. A man with a good, broad education must be able to think and draw conclusions; and in dentistry he should have that power. The great object in teaching dentistry is to enable the man to do something. The dentist should not expect to be able to render the same service to his patient when he leaves college as he can after he has had years of experience. I do not believe that any patient expects that. If they did what would be the value of the many years of experience that we count so much on? If they did, there would be no reason why the man just from college should not be entitled to the same compensation as the man who has had twenty or thirty years' experience, and whose work has received recognition.

If a man has great ability and is a leader in his profession, it means that his foundation was well laid. At the same time, if there is a time in a man's life when he can lay a good foundation it is during his college life. If he fails to do it then, he never will.

As a teacher I want my students to have a broad foundation in school. I know of no way to illustrate this better than to speak as a father. I have a son who entered college this fall, and the method I am pursuing with him would, perhaps, express my feelings better than anything I could say at this time. I expect that he will apply himself for, say, three and a half hours

a day at the dental technic work; that is, prosthetic, operative, etc. Then, in the latter half of the term he will have the practical work; plate work, crown and bridge work, operating, perhaps, for about five hours a day. The rest of his time I will expect him to devote to the scientific part of his work, laying his broad foundation. Now, what will he do during that time? I will say that it will be largely laboratory work of one kind and another, especially in the physical laboratory, which should be the important part of the work. But I believe that, on account of the great cost and the delicacy of construction of the various appliances used in this work, that it will not be practicable to place them in the hands of the student to use by himself. It should be more of a demonstration course, the instructor carrying on the work and demonstrating to small sections of the class so that every student can see and carry off the idea of what is done and what it is done for. I think that they could acquire the necessary knowledge in less time when the work is done in that way than if they could use the instruments themselves and work out the course individually; this would also consume a great amount of time, more than they have at their disposal.

. There are other branches of laboratory work that I feel are fully as important as the course in physics. Take, for instance, the use of the microscope in histology. This work will be done during his first two years in college and will consist of the mounting of a hundred or more microscopic sections. That is fine manipulative work, work that requires exactness and the careful consideration of details in every respect. It is a means for cultivating honesty and truthfulness. If he is not honest in preparing his slides, his work will show it in the end. So that in selecting work for the student it should be done with a view that it will develop manipulative ability, and the power to think logically and to draw conclusions, and then I believe we will have men who are better dentists than we had twenty or thirty years ago.

In the case of my own son, I believe that he can to-day, although in college less than a year, do more artistic, more ideal, better work in prosthetic dentistry than I could after I

left the dental college with four and a half years of preparatory work. If he has that better foundation and ability, it is because of the different method of training he has had. I am firmly convinced that we are producing better dentists to-day than we did twenty or thirty years ago. So that as we enter upon the four years' course in our dental schools, I trust that it will be our aim to put in as extensive a course in physics and other laboratory work as possible, because I believe that it is a great source of instruction. There are other departments of physics that the student should be instructed in, but it need not necessarily be laboratory work; it can be taught in the lecture room accompanied by thorough demonstrations.

Dr. Black has confined himself almost entirely to the application of power, of force. I believe that they should also receive considerable instruction in the physics of light. If the members of the dental profession had more knowledge of that subject to-day, we would not hear so much discussion about the different ways of putting in inlay work; whether it should all be of one material or of different layers, or of different qualities of material. Some materials which are highly recommended would not be considered at all because they would appreciate the effect of light on the inlay.

So I believe that the principles underlying physics or natural philosophy should be more thoroughly taught in our schools. Of course, the laboratory method of teaching is much slower than the didactic work, but a portion of the time could profitably be put in in the laboratory and then the teacher could fill in by thorough demonstrations in the lecture room so that the students would get a complete course, one which would be of considerable value to them in their career as dentists.

Dr. J. P. Buckley:

It is with a degree of reluctance that I attempt a discussion of this very elaborate and comprehensive paper, for I am not a teacher of physics, except that in teaching chemistry, which pleasure I enjoy, it is necessary, oftentimes, to consider the subject of physics, as the two branches of science are very closely related.

We are fortunate at this time, I take it, in having this subject presented by so thoroughly competent a teacher as our essayist. Few men, indeed, in our profession have spent as much time applying physics to dentistry as has Dr. Black, and as a result of this application he has made many valuable discoveries, which have greatly benefited the entire dental profession.

Before we can enter into an intelligent discussion of the subject of teaching applied physics, it will be necessary, first, to know what is included in general physics, and then decide upon the special subject to be treated in our applied course.

General physics is a science which correlates with algebra, geometry and chemistry. Its correlation to chemistry and metallurgy is of special interest to us, as dentists, and must ever be remembered in teaching applied physics, as was clearly shown in the essay. Both physics and chemistry are sciences which deal with matter; matter constitutes the universe, the parts of which are so intimately related that it is impossible, in many instances, to establish any sharply defined boundaries between these branches of science. I know it is true that we usually think of physics as dealing with the phenomena of matter involving simply a change in position, form or condition; and chemistry as dealing with the phenomena involving a change in composition, but the distinction in nature searcely exists. General chemistry has always been taught and fully appreciated in our dental schools, while physics, as such, has been given only little attention, if any. That a course in applied physics should be installed in our four-year curricula is self-evident, and I am going to take the liberty, just here, to wander from the theme of this discussion long enough to say that a course in applied chemistry should also be inaugurated.

The essayist has mentioned the practical subjects which, in his opinion, should be taught in this special course. Now it will be difficult to teach students applied physics unless they have some elementary knowledge of the science; and, in order that we know where to begin this work, it will be necessary to ascertain as nearly as possible the amount of elementary physics studied by the students previous to entering our dental schools. As most of our matriculants are high-school graduates (it is to

be hoped all will be in the near future), we must know approximately how much physics are taught in the average high-school.

It was my pleasure, a few years ago, to be connected with the teaching force of the state of Indiana, and in that capacity I was privileged to meet the teachers in conventions from other states. At that time, physics was taught in the high-schools from the standard text-books. I learn, however, that the general trend in teaching the subject to-day is towards more experimental work in the laboratory. This is necessarily limited, on account of lack of equipment. I also learn with a great deal of satisfaction that the high-schools throughout the country are working towards a unification of their courses, not only in physics, but in other branches as well. This is certainly encouraging and gratifying to the professional schools, who are to accept these graduates and complete their education.

The essayist has brought to our minds quite forcibly the fact that there is much in the science of physics which appertains to modern dentistry; but I fear, in teaching this application, we shall be laboring under grave difficulties, until some capable teacher assumes the responsibility of writing and having published a thoroughly up-to-date text-book, and laboratory manual, which will be correlâted to chemistry, metallurgy, materia medica, pharmacy and other branches of dentistry, in such a manner that the subjects mentioned may be studied with reference to their interdependence upon each other, both in the lecture-room and in the laboratory. This text-book should contain nothing but that which is true and capable of being verified by the teacher. It should be composed of the practical ideas from all good text-books, together with new ideas on applied physics not yet published. With such a text-book and manual, a uniform course could be given We are sadly in need of good, modern text-books. There are too many subjects taught in our dental schools to-day which have to depend for their essence solely and entirely upon the practicability and individuality of the teacher This institute, it seems to me, could do the profession generally no greater service than by exerting its influence in having some of its specially qualified members write

and have published up-to-date text-books upon applied physics, materia medica, chemistry and other branches which could be mentioned.

I shall not attempt to suggest specifically what such a text-book on applied physics should contain, but by giving some thought along this line we find many practical subjects suggesting themselves. The essayist has considered in detail the application of forces, and the principles of mechanics, to all phases of dentistry, and carries it into what I should more properly specify as a course in applied metallurgy. While I consider this to be thoroughly interesting and practical, I feel that he has emphasized this application of forces, in teaching applied physics, at the expense of other important subjects, such as heat, light and electricity. Where or in what calling is *heat* used more than in dentistry? Who should know more about its sources, effects, transmission and application than the modern dentist? Light:—its sources, intensity, reflection and refraction, should be thoroughly taught to our dental students, for light is an important factor in the mouth, in many instances, as well as in the operating room and laboratory, and no dentist is thoroughly up-to-date unless he knows how to handle such instruments of precision as the microscope, photo-microscope, polariscope, X-ray apparatus, etc., all of which depend upon some phase of light for their value. Electricity has been more fully considered in the essay than the subjects of heat and light, yet not as fully as I feel it should be in this special course. This phase of physics has also been treated by itself before this body, and I shall not take up your time by repeating the discussion more than to say that electricity should be thoroughly taught in our course of applied physics.

Perhaps second in importance to a good text-book in teaching these practical subjects, and absolutely necessary in the absence of such, is to have a teacher capable of presenting them in such a manner that they will be interesting to the class.

The general pedagogical principle underlying the method of teaching applied physics differs in no particular essential to that which underlies the method of teaching any subject. A teacher can never interest a class unless he has the ability to hold their attention, and the attention of the class can be had in one of two ways only:

By arousing their curiosity, or by showing them that that which we are teaching has a direct application to their future life. Personally, I never had much sympathy for the teacher who has to prey upon the curious nature of the students in order to hold their attention. The valuable teacher—the one who *teaches*—holds the attention and never fails to interest the class, because the practical application of the subjects taught is never neglected. This causes me to reiterate a similar statement, which I made before this body a year ago, in discussing a method of teaching dental metallurgy. In teaching applied physics or physics as applied to dentistry, the teacher must have two special qualifications—a thorough knowledge of elementary and advanced physics, and a knowledge of the practice of dentistry.

Dr. Black (closing the discussion):

I do not know that I should take up the time of the association in saying anything further upon this subject. Of course, I realize that it would be impossible to have any considerable discussion because the subject is new to the dental teacher. I am sorry for that, but I am well satisfied that in a few years from now this subject will form a prominent part of the dental curriculum and then we will be in a position to speak further as to the value of a course in physics in the dental school.

SYMPOSIUM ON THE MANAGEMENT OF TEACHING BY DEMONSTRATORS IN THE INFIRMARY.

By Dr. S. H. Guilford, Philadelphia, Pa.

I am not prepared to present this subject fully for the reason that I did not give it the consideration I should. Further, when we are familiar with a subject we rarely prepare ourselves for public expression. What I shall have to say will be largely along the line of what I am familiar with in our own school.

To begin with, we all, from time to time, have to get new demonstrators for the infirmary or other positions in the college. Some men leave because their practice has grown and requires a greater amount of their time, and they cannot afford to do work in college; some for other reasons. Hence we are constantly on the lookout for men to fill these positions. Now, let us suppose that a vacancy occurs and after looking around we find some one who is capable of filling the position. The first thing to do under the circumstances, because in all probability he is a man who graduated some years before, is to bring him into the college and acquaint him with the present day methods in the school. We take him in hand and explain to him exactly the way in which we conduct our infirmary; tell him the duties of the demonstrators; what they are expected to do, and what not. Give him to understand who is the chief man in authority; who comes next, and also what his particular position will be. After that is done, and placing him in the infirmary, it becomes necessary to visit that infirmary from day to day to ascertain whether he is doing the work properly and carrying out your instructions. After he has been appointed it is also necessary to place him in proper relation with his associates in the infirmary and give them to understand that he is there to do certain specified work.

Every infirmary must be properly organized in order to get the right amount of work out of it. We have head men, men next to them, and several assistants. Those men who act as assist-

ants usually have some specific work to do. One, for instance, will pay special attention to the pathological cases; another to the practical work, the crown and bridge work. Others, possibly, to the preparation of cavities, the insertion of fillings, etc. Of course, all the demonstrators are prepared to take hold of any part of this work, but each one is supposed to have individual control over his particular portion of the work.

Now, if we find that this work is going well, and we are supposed to see that it does, another thing is necessary. It is not sufficient to have the head demonstrator and the assistants working in harmony unless you are there with them and understand them. In order to get a full understanding it becomes necessary to have a certain number of meetings during the winter between the professor who superintends that work and the various demonstrators. These meetings may be held once every two weeks, at which time the work in the infirmary is gone over. Ask questions about the clinic; the run of the cases, whether any peculiar or unusual cases have presented themselves, and in general what work is being done by the demonstrators as well as the students. You can give special instructions at this time; or if they are not carrying out your ideas properly you can set them straight.

Those who demonstrate in the infirmary, or have charge of this work, must be in perfect accord with the didactic teachers in the various chairs. In order to do that we have found it necessary, when a new demonstrator is appointed, to have him attend the lectures on that subject and become familiar with the professor's teaching and his methods. We also require that those who have been there for some time go in occasionally and attend the lectures. But the new man must attend all of them in order to brush up on anything new that has occurred since he left college. In that way, the new ones as well as the old ones are in perfect harmony and accord with the chair, and if they have any executive ability at all they ought to be able to carry on infirmary work.

I need not mention the fact that all the infirmary work should be very carefully supervised by the chair having that in charge,

in this case the chair of operative dentistry, so as to see that everything is going well.

I realize, and have for many years realized, the difficulty of getting good demonstrators, or taking such material as we can get and moulding it into good demonstrators. It is one of the hardest problems of my life to get suitable men to serve as demonstrators. I remember many years ago Dr. Brophy said to me, "Can you send me a good demonstrator from the east?" I said, "No, I can send you a dozen good professors, but not one good demonstrator." Professors are comparatively numerous, but good demonstrators are very hard to get. So that in my official position I am constantly on the lookout for good material. It does not do to wait until a demonstrator leaves and then take steps to fill his place. I try to have an understudy for every demonstrator in the college. I put him in as an assistant and prepare him for the work so that when the time comes he can step right into the demonstrator's position.

It is very well to have the different chairs filled by competent professors and teachers, but at the same time it is just as important to have men under you who are able to carry out your ideas and instruct the students properly. A teacher is made, and not necessarily born, as we hear it said so often. His efficiency is largely developed through long practice. You can hardly expect anyone to take up a certain line of work and do it well at the start. He must be trained to do it. The success of every institution depends not only on the teaching but on the actual demonstrations in the infirmary, and we cannot afford to overlook this.

Watch your demonstrators and assistants and see that the work they turn out is satisfactory to you. Do this not only for the good of the school, but in common justice to the student.

DR. J. BRANSTON WILLMOTT, Toronto, Can.:

MR. PRESIDENT AND GENTLEMEN:

Considering the comprehensive character of the program prepared for the present meeting of the Institute, any lengthy paper on the subject assigned me would be out of place. A "symposium" on so practical a subject as the "Management of Teaching by Demonstrators in Infirmary," prepared by four persons engaged in teach-

ing the same subject, must necessarily, in its detail, involve considerable repetition. In my brief contribution I will confine myself to the "general" rather than to the "detail."

The teaching of practical dentistry in the infirmary, to be effective must be preceded by a large amount of previous training. Dentistry is a *science* and an *art*. The *art* of dentistry is probably best acquired in a well organized infirmary under the direction of competent demonstrators. The *science* of dentistry is acquired in the lecture room and the laboratory. Just as the surveyor and the engineer first master the science of mathematics and then work the science out in the laying out of a railway line or the building of a bridge, so the dentist should first master the scientific aspect of dentistry before he is ready for a successful training in the art of dentistry.

This science of dentistry should include dental embryology, dental histology, dental pathology, including all the common pathological conditions incident to the dental organs; dental hygiene, dental therapeutics, macroscopic and microscopic anatomy of the teeth, dental chemistry, dental metallurgy. He should be familiar with the scientific treatment of caries, the preparation of cavities, the preparation of filling materials and the insertion and finishing of fillings. In addition he should have had such systematic digital training as shall educate his eye and hand to the easy and proper use of instruments.

Having fairly mastered these preliminaries the student of dentistry may now, but not before, intelligently enter upon the study and practice of the *art* of dentistry on the living subject in the infirmary.

The equipment of the infirmary is not now under consideration, but in passing, we may observe that in the matter of fixed equipment, such as light, chairs, cabinets, wash basins, etc., it should be liberally supplied. Each student should be compelled to furnish himself with everything necessary for all the usual operations. It is very desirable for many reasons, especially for convenience of demonstration, that in any given school this equipment should be practically uniform.

If the professor of operative and prosthetic dentistry could do his own demonstrating we would have an ideal condition. With

large classes this is not possible. The duty must be devolved upon a corps of demonstrators. In the appointment of these great care should be exercised, that they are of good character and standing so as to command the respect of the students. They should be thoroughly familiar with the methods of the head of the department and entirely in accord with them.

They should be loyal to the teaching of the staff and to the school in which they are employed. The number required will vary from one to each eight or ten students, to one for each fifteen, or even more, students, engaged in operating for patients, depending on the experience of those over whom he is placed. In a school of, say, sixty seniors, with sixty chairs, and seven demonstrators in the infirmary, one would be given charge of the examination and extracting rooms, one the impression and prosthetic room and the prosthetic work, one the crown and bridge room, one the orthodontia department, the remaining three would supervise the operations for filling teeth. One of these latter would assign the patients, exercising judgment to select an operator whose skill was equal to the requirement of the patient. As their special duties permit, all demonstrators assist the students in any department of the infirmary.

A natural order of "evolution" in operative practical work by the student would be, first the examination of the mouth, noting the operations required, proceed to simple cavities to be filled with plastics, then treatment of pulpless teeth, then more difficult cases of plastic fillings and simple cavities with gold, then restoration of difficult cases with gold, then the use of porcelain fillings, and lastly when skill in the use of instruments has been well developed, the thorough removal of all deposits on the crowns, necks and roots of teeth, and the treatment of pathological conditions of the pericemental membrane.

Where previous private pupilage is not compulsory, most students enter the infirmary entirely ignorant of a great deal that will be immediately required of them. Many of them have never even seen a filling inserted for a patient. To assign a patient to such a student is inexcusable cruelty to the patient. Such students should first be appointed as assistants to experienced senior students. They could expedite operations by preparing the amalgam, mixing the cement, annealing the gold and placing it in the cavity with pliers,

etc. A week or two of experience in thus "fagging" for a senior and watching him operate would be of the greatest advantage to them when in the near future they are called upon to undertake a patient on their own account.

When a student without personal experience comes into the infirmary the demonstrator should aid him in his manipulations and in most cases perform the operation, or part of it, for him. He should have him under very close observation lest he go astray and injure his patient. As he acquires confidence and skill he should be taught to depend on himself. Too much assistance on the part of the demonstrator is a great evil. The student who depends upon, and gets, the assistance of the demonstrator to help him out of every little difficulty, will not develop the resourcefulness which is essential to success as an operator, and when left to himself will fail. It is of the greatest importance to the student of dentistry that he get, as early as possible in his course, a clear cut mental conception of what a successful operation should be when completed. This he gets partly from didactic teaching and partly from observing good demonstrations. When he has added to this a knowledge of the requisite manipulations, even though this knowledge may be largely theoretical, all that he requires to become expert is practice. When he has reached this stage of development the demonstrator should only interfere when it is necessary to protect the patient. He will learn infinitely more by meeting and mastering the numerous difficulties which will beset him than by merely watching the expert demonstrator deftly remove them for him.

No student should be permitted to "skimp" any work or operation. Everyone who has had any experience in infirmary work knows how great a tendency there is among a certain class of careless and indifferent students to do this. As a check upon it, no patient, for whom any work has been done, should be permitted to leave the infirmary until this has been inspected by a member of the staff. The knowledge that this inspection cannot be avoided will be a powerful deterrent to careless and slovenly operating. While it will be conceded that the primary object of the Dental Infirmary is the instruction of the student in the "Art of Dentistry"

the patient is a very important factor in the instruction, and should be very carefully protected, by the demonstrators, from the malpractice of careless or ignorant students; this is all the more incumbent on the officers of a school from the fact that most of the patients are not there from choice but because they lack the pecuniary ability to go elsewhere for their dental treatment.

DR. W. P. DICKINSON, Minneapolis, Minn.:

The title given for the subject under discussion does not make it perfectly clear what our executive committee had in mind when it was proposed.

The term "management" might be construed to imply difficulty of controlling or directing, or it might imply simply the act of superintending or conducting. My thought is not to quibble over the term, but to indicate a slight embarrassment regarding a point of view.

That demonstrators are a necessary adjunct to most of the chairs, is a fact not necessary to enlarge upon; as to their duties or the character of their work, and their relation to the chairs, under which they serve, something may be said.

From the college announcements it may be readily seen that the corps of demonstrators are not very permanent bodies; that is, that changes are much more frequent than in the list of professors and instructors. It is a question of serious import to the conscientious executive and faculty oftentimes, as to where capable assistants may be found to carry out the teaching of the heads of the departments. In a large degree it may be said that teachers, like poets, are born, not made, and the discerning professor is ever on the keen lookout for developing talent that may later be utilized in his particular branch.

The policy of employing graduates, just out of school, for two or three half days each week, for a pittance and encouragement that connection with the school will be of enough more pecuniary advantage for remuneration, is to my mind a grave mistake. This leads me to say that when a student evinces special aptitude or capability for imparting knowledge to his fellows, this faculty should be encouraged and developed under careful direction of the chair, with the view of ultimately commanding his entire time, with salary commensurate with the value of the services rendered.

The developing of latent talent must be governed by circumstances; it may be permissible in individual cases to employ an undergraduate to assist in demonstrating the technics of a previous session's work, for experience must be obtained and the manner of getting it is as well expressed as can be by the maxim of Commenius, "let those things that have to be done be learned by doing them," or by accommodation, the best way to learn teaching is to teach. All this implies of course that the learning to teach must be under competent guidance and supervision.

It will be taken for granted that the heads of the infirmary departments, as well as others, have been chosen for their known ability and capability of conducting the special work entrusted to their charge. I shall assume that the idea underlying the discussion of the subject in hand is, how to obtain the best results from the pedagogical standpoint. Given the two factors, competent heads of departments, and demonstrators of good capability (I use this word instead of "ability" advisedly) how shall the best ideals be reached? First, to my mind, the details of presenting any particular branch should be in the hands of the chair, and the assistants and demonstrators should be held responsible directly to that chair. In order that there shall be harmony or unity in the teaching, the chiefs of each department should have regular meetings with his subordinates and take up the work in a sequential manner, and go over the entire course, from the simplest element to the most complex operation that will be demanded of the student while in the college.

Possibly it might be inferred that a slavish compliance with the professor's ideas would be required; on the contrary, there should be no stifling or repressing of the individuality of any member of the corps, but the very fact of frequent conferences, particularly during the early part of each session, would benefit all, from the chief to the most inexperienced in the work.

From the foregoing it will be seen that the so-called "Clinical Instructor" is entirely eliminated, the contention being that the student should be thoroughly grounded in a course of study, carefully thought out and systematically arranged by the faculty, as a harmonious whole.

"Too many cooks spoil the broth," and there will be time and opportunity enough after leaving the college halls to observe the methods of others than the faculty and regular instructors.

Dr. Jules J. Sarrazin, New Orleans, La.:

At the outset of any consideration of this subject two opposed contentions may arise. The first is that dental students might benefit by a diversity of methods being didactically discussed and practically illustrated. The second is that absolute uniformity in teachings should exist between didactic and practical work, for fear of confusing the student's mind, instead of supplying a sound scientific basis for him to evolve from. While the first contention may contain beneficial truth when applied to a post-graduate course for practitioners of a few years' experience, there is no doubt in the writer's mind that such a course would confuse the unexperienced student who could be wholesomely fed only with methods based on dental anatomy, histology and physics applied to cavity preparation and filling. Moreover, such a basis will permit no deviation from correct outline, resistance and retentive forms of cavities and fillings, nor from the accurate introduction and knuckling of filling materials; adaptation, edge strength, flow, contraction and expansion, all being included, so that no diversity in the correct application of general principles involved is possible.

The ideal means of assuring close adherence of practical illustration to didactic teaching would no doubt be a personal, constant, day after day supervision of the demonstrators' work by the professor. This is, I believe, not often possible. It is not so in the Crescent City, unfortunately. We have arrived at other means of obtaining harmony between word and deed, which, although not the writer's ideal, seem an acceptable substitute. Our professor of operative dentistry is also professor of dental anatomy and operative technics. This at once permits application of dental anatomy knowledge to operative procedures in the treatment and filling of root canals, in cavity shaping which will weaken neither the functional faces of teeth crowns nor lobes of formation not continuous with teeth roots (or will otherwise dictate their complete removal), and in the shaping of proximal faces and their knuckling at marginal ridges. It allows emphasizing the necessity

of occlusal stress being placed on filling material itself where natural binding marginal ridges are gone. This combination of didactic branches also suggests the handling of operative dentistry as identical with operative technics, plus oral secretions and the means for their exclusion, plus the living tissues and micro-organisms, plus the pigmentation of dentine, and the nervous system of the patient.

An unusual condition is that our Dean is at the same time demonstrator of operative technics (with a capable assistant under him) and professor of clinical dentistry, with clinic demonstrators also under him. This arrangement has grown out of the fact that he and our professor of operative technics, operative dentistry and dental anatomy have found that their ideas in operative dentistry ran in similar grooves, and have accordingly reached a conclusion, at least convenient, that their grooves must be correct since scientific basing will not permit divergence in such matters. They have agreed on some details, such for instance that root canals had better be enlarged by drilling than be septically pumped by cleansers, and had better be filled with gutta percha made germicidal than with semi-solid paraffine, that any incisal angle or marginal ridge, which, after the preparation of a simple proximal cavity, might be approached closer than 3-32 of an inch by a morsal wall, should be removed, except in cases of non-functional bicuspids or molars, and provided that the patient would solemnly promise never to allow an antagonist to be inserted, as there must be exceptions to all rules. Under this same exception, *but in no other case,* is it permissible to form a proximo-occlusal cavity for metal with a V-shaped morsal opening, and with retentive grooves in the buccal and lingual walls reaching vertically in the morsal direction, this provided moreover that the natural adjacent occlusal grooves in the crown perfect. The two department heads have otherwise easily agreed that in all usual cases correct retentive proximo-occlusal filling form, to oppose any strain, requires step formation with the extremity of the morsal dovetail floor dipping pulpally, and with anchorages placed at bucco and linguo-gingivo-axial cavity angles only, and that matrices are absolutely indispensable to all properly made compound amalgam fillings, and nearly so to gold disto-occlusal ones. They have also

agreed that step retention was indicated in incisors where an incisal angle was absent, in preference to a lingual horizontal auxiliary dovetail, which latter in its turn became preferable when an incisal angle could safely be preserved to avoid filling material display. They have agreed on occlusal anchorages for compound amalgam fillings being wider-necked and slightly deeper than those for gold, on cavo-surface angles of histologically inclining enamel walls being beveled for gold and not for amalgam, and on the proportion of cohesive bulk to non-cohesive gold placed at the cervical part of a compound cavity being *at least* two to one. In fact they have as much as possible made sure that the heads of the practical and didactic departments would both preach the same sermon.

This first step having been made it has been our custom to call joint meetings of operative technique and clinic demonstrators, and with both above mentioned heads present, to rehearse matters, laying down the lines of teaching so as to make them harmonious. Then follows putting theory into practice by one professor lecturing and clinicing and the other overseeing the work of technique and clinic demonstrators. This has been our method, based on the conclusion that didactic and practical teaching must be and cannot be otherwise than the same, if correct. There is, however, one subject on which my mind is ill at ease, because, in the absence of a solution of the question by general experience, I see a necessity for teaching two different methods. This is the retention of porcelain inlay incisal angle or mesio-morsal first bicuspid restorations. Scientific basis and experience have established beyond doubt that metal fillings of that class could be safely retained only by step formation. An iridio platinum pin, No. 23 or 24 B. & S. gauge hooked at a dovetail's extremity, and with a rounded head baked in the porcelain inlay, first cemented in the cavity and afterwards veneered over with cohesive gold, is ample to afford the necessary step retention, I believe, without weakening the porcelain on account of its small diameter and rounded head, provided it be judiciously placed. Lingual horizontal auxiliary dovetails will here be indicated instead of incisal steps and deep enough central groove occlusal anchorages in bicuspids. The preceding refers of course to crowns with live pulps, the others not presenting the same difficulties.

On the other hand, some porcelain inlay experts assert that a good cervical seat for the inlay, combined with the adhesiveness of cement (which should not be much over 1-1000 of an inch thick in the finished work except at and nearing the cavity floor), will satisfactorily withstand the average 200 pounds pressure of normal occlusion. Joiners expel all the glue possible between wood joints, but do not resort to that construction to resist force from a plane parallel with small glued surfaces. A mast is not made of truncated cones separately glued together under pressure, and a lead pencil opposes about two square inches of glued surface to a working point which hardly strains. Yet, it is confidently claimed that a short cement joint, lying in a plane parallel to that of the enormous force applied, will save the inlay, provided it be well seated cervically. For my selfish good and that of suffering humanity may this be true! For the present, however, a departure from the rule of monotheism in teaching might be made on this subject and our advanced students be given acquaintance with two opposed methods.

I close in the hope of having said only one useful word on a subject so vital.

GENERAL DISCUSSION.

Dr. A. O. Hunt, Omaha, Neb.:

The question of the relation of the professor and his teaching to teaching methods in the infirmary is one of the vital questions of the dental school. There are so many difficulties that enter into this relation that are almost insurmountable that to make a satisfactory adjustment is a matter of the greatest difficulty. The things that the professors teach and the things that the demonstrators have to do are not always in the best relation to each other. This is not the fault of either one or the other, but the result of a number of conditions. Every teacher in didactics has trouble to impart the desired information to the student, and at the same time fix an idea in his mind of the very highest order. He may even go to extremes in teaching to accomplish this purpose. This is undoubtedly more nearly true in the department of operative dentistry, as the ideals and the conditions met with in the infirmary are not always ideal. The professor does not go over all the

minute details that are essential to operative dentistry, hence the schools have adopted methods of technique that give the student a good working basis, the details to be filled in by the demonstrator during the performance of the practical work. In the lecture room, as well as in the technic room, conditions may be made, but in the infirmary these conditions are very much interfered with, or are not the same. The indifference of some students, the indifference of the patient, the lack of intellectuality in the patient, interferes with carrying out perfect instrumentation. One difficulty with some students is, they must be shown everything. They are not all disposed, if they have an operation in hand, to start from the beginning of the case and make a careful diagnosis to work out in their minds all the conditions that are present, and thus arrive at the best methods that they should pursue in getting ideal results, as they have been taught to do in the lecture room, the technique room, etc.

Now, no matter how efficient the demonstrator may be, he cannot entirely overcome conditions like these. He cannot always make the student think; he can make him do certain things by not giving him credits. To help to overcome this difficulty, I adopted a plan many years ago of crediting the work step by step as it progresses, hoping thereby to inculcate the habit of thinking and diagnosing, reaching results mentally first, and then practically. That is, mark him upon the diagnosis of a case as one step; the preparation of the cavity as another. The manipulation and preparation of the material to be used, each represents a mark for him. He cannot go beyond any one stage without having it examined, because his card is punched at each division so that any demonstrator knows what the last mark was given for. The result is it prevents the doing of serious harm and going beyond the point where teaching is essential and absolutely necessary.

There is another difficulty that presents itself, and that is the demonstrator himself. Many demonstrators have the ability to tell how things should be done better than they can show the student how to do it. Others have the ability to show the student how it is done better than they can tell how to do it. Demonstrators of either character are valuable, but these are conditions. We do not find in demonstrators any more than in persons in other walks

of life and professions, that they possess all the good attributes and good qualities that are ideal in the teaching of dentistry. One man's ability runs in one direction a little stronger than in another. Schools that are fortunate to possess demonstrators who possess all these qualities and attributes are to be congratulated. Unfortunately that kind of a demonstrator is the one you cannot keep very long. Their individuality and ability naturally carry them out into the world doing for themselves; whereas everyone knows that college work offers but little compensation.

By a system of examining each step of the operation, the student is put on his mettle all the time, the best interests of the infirmary are being looked after and the patient is certain of getting the very best work. The credits are punched out of the ticket and are figured up so that the proper credit may be given for that particular operation. This method has proven itself as feasible and it comes very near being perfect.

Dr. J. Q. Byram, Indianapolis, Ind.:

We have had five subjects from five deans. I will speak from the other side of the question. I do not believe all that Dr. Hunt has said, that you cannot make the student think in the infirmary, or rather that the student does not think there. If he does not think there, something is wrong; he should be taught to think while he is working on the case. I will admit that there is a tendency for him not to think, but if our demonstrators are trained so that they simply go and help the student when he does not actually need help, it is true that in a short time the student will not think. I believe that we can train students to think in the infirmary and in every department. If the student comes to me for assistance in the technic department, I tell him to reason out how the operation should be done, and if he cannot get it, then to come to me for assistance. I do the same thing in the infirmary. As an example, a student comes to me with a case of pulp treatment. He may be trying to remove the pulp, and even though I try to give our students a thorough course in dental anatomy, many of them forget that a lower molar has two roots and that the mesial root usually has two canals. He cannot find all the canals. I do not try to find the canals for him, but I refer him to his dental anatomy and tell him to do all he can without my help. If, after working

a while he cannot find the canals, then I assist him. When I demonstrate in the infirmary I do not help the student by doing the work, but I try to help him to help himself.

As to the difficulty of securing good demonstrators: Every one will admit that it is exceedingly difficult to get good demonstrators (that is the reason I was "fired" from our infirmary). I think that one difficulty is that when we get a good man it is only a short time until he leaves us. The trouble is that the demonstrator gets a very small salary. He probably gives half of his time to the college and the remainder to his private practice. He is a young man beginning the practice of dentistry in the city, and if he is the right kind of a man, he begins to build up a practice after he has been with the college but a short time. He realizes more from his practice than from his college work, and as a result he stays with his practice. In most cases the college prefers to look for another man rather than pay him enough to justify him remaining with the school.

The trouble is that you do not pay these men the salaries which justify them staying with you. You cannot keep a good man unless you pay him enough. The cheap man is always unsatisfactory, and you do not want him. Pay your demonstrators well and you will always have good ones.

Dr. C. N. Johnson, Chicago:

I have just a few words to say on this very interesting subject. The management of the demonstrators in the infirmary is becoming to me more simple every year. There has never been any difficulty in having perfect harmony in my department. I have never experienced the slightest tendency to lack of loyalty on the part of any demonstrator in the institution with which I am connected. I want to pay that tribute to the demonstrators who have taught under me, and many have. One reason, probably more than any other, that is responsible for this harmony, is that for the most part the demonstrators in our college are graduates of our institution, and I leave the demonstrating to them.

I have, as the superintendent of the department, on the floor a man who is superior in ability, and he is absolutely loyal. He is there all the time and all matters in the infirmary are referred to him. He reports to me every week, and if there is the slightest

discrepancy it is referred to me at once and it is rectified; not by me but by him on my advice. The reason I keep away from the infirmary is this: It used to be the case that when I went through the infirmary to see what the students were doing, that students would call me here and there to give my judgment on this or that case. Nine times out of ten the student was calling me to see whether he had received the proper instructions from the demonstrator. He had already appealed for assistance to the demonstrator and had received his instructions, but he also wanted my idea, and because of the fact that I was sometimes able to decide the question more rapidly or in a different way, it was demoralizing at once. It gave rise to the suspicion that the demonstrator was not entirely qualified. And I ask my students to show the same loyalty to my demonstrators that they show to me.

I want to cite just one instance that was instrumental in making me change my plan, and it is why I will not, unless requested by the demonstrator, go to a patient and demonstrate. One day, in the infirmary, a demonstrator had a case of a lower second molar. The first permanent molar was out; the rubber dam was on; the second molar was tipped slightly forward so that the student had considerable difficulty finding the root canals. He said that he had found the canal in the distal root, but could not find the one in the mesial root. He called the demonstrator, who tried but could not find the canal either. The demonstrator was called suddenly away from the chair and in his absence the student slipped around and called me without informing me that the demonstrator had seen it. I went, looked the case over, picked up a bur and exposed the distal canal. Both the demonstrator and the student had, on account of the tipping of the tooth, mistaken the mesial for the distal canal. It was the laugh of the whole college. It went around the infirmary like wild-fire and it interfered with the demonstrator's efficiency as a teacher in our college.

Demonstrating should be left in the hands of the demonstrator, and there should be absolute loyalty on the part of the demonstrator to the professor.

I want to express my opinion, as Dr. Byram has said, that Dr. Hunt is mistaken in regard to the fact that the demonstrator cannot make the student think in the infirmary. I use the expression

that Dr. Hunt used, but I do not believe that he means that. The very thing above all others that the demonstrator is there for is to make the student think. The worst kind of demonstrating I know of is where the student calls the demonstrator to the chair and asks him what he is to do next, and the demonstrator picks up an instrument and does the work himself. That is not efficient demonstrating. I instruct my demonstrators something like this: You must not allow any student to do damage to the patient, but when the student comes and asks you what he is to do in that particular case, stop him and ask him, "What is your opinion as to what you had better do?" Make the student think the thing out himself and never give an opinion until the student has expressed himself on that particular point. This is not the way that these things were done years ago when we sent students out of our schools mere machines, without any judgment whatever. Their reasoning ability had never been developed. But now the student himself decides the matter, and then if there is a mistake in his reasoning he is corrected by the demonstrator before any harm has been done to the patient.

All along the line of teaching it is not merely a matter of pounding knowledge into the student, but of developing his reasoning faculties. There is no teaching more vicious than that which makes a mere machine of the student. He should be taught to think for himself; let him solve his own problem and you are doing him vastly more good than by continually showing him how to do it.

Dr. Geo. W. Dittmar, Chicago:

I have had a little experience as a demonstrator, and one question comes to my mind in this connection, and that is this: Would Dr. Johnson teach or instruct that student before the patient as regards to the proposition in hand? Would he have the student make the diagnosis there and probably outline his method of treatment, and then, perhaps, have it entirely wrong? If the demonstrator's opinion is at variance with that of the student, and if he gives expression to that opinion, may not the patient lose his confidence in the student?

Dr. Johnson:

It is impossible to escape consultation in this matter in the presence of the patient. Any demonstrator who has any tact at all, even if the student is entirely wrong, both in his diagnosis and the method of treatment, can correct that error by using only technical terms so that the patient will not be cognizant as to what is being said.

Dr. A. O. Hunt, Omaha, Neb.:

I certainly do not want a wrong impression to prevail as to what I said or meant. I was speaking of the conditions that exist in the infirmary, and one of the conditions I named was the tendency of some students not to think. Often they want to have something demonstrated, saying that they can understand it better if they see it done. On occasions that, perhaps, is the best thing and it may lead to better results, but some students do not like to study a thing out, work it out for themselves. That is what I want to be understood as having meant, and not that it is a general thing among students, but that it is too common.

As to whether you are going to debate a case in the presence of the patient: While I would not in any way, or for any reason, injure the feelings of a student in the presence of a patient, yet I believe that the best results will follow if you keep in the mind of the patient all the time, and in the mind of the student as well, that he is a student under instruction, and that he is not expected to know everything. The best results are obtained by keeping in the mind of all concerned the relation of things. You are instructing the patient at the same time as to the nature of the trouble and what had best be done to remedy it. I have always adhered to the belief that a successful practice is better maintained by having your patient know as much as possible about dentistry and in the infirmary you are instructing many people. I can see no harm in debating a question in the presence of the patient so long as it is done in the proper way without humiliating the student. Do it in a thoroughly scientific manner and only with reference to the particular case in hand.

DR. G. V. BLACK, Chicago:

I have listened to this discussion with a great deal of pleasure. Such a discussion as this could not have been held five years ago. We as teachers did not have a sufficient amount of training in this work to have held such a discussion; one that is as broad in its bearing as the discussion we have had to-day. To me it means great progress in our work. Now a word or two as to some points in connection with the training of the student in the infirmary.

I like to have my demonstrators meet me every week and talk to them about what I am lecturing on to my class at that particular time, and have those particular things reinforced by the demonstrators in the clinic room following the presentation of the subject in the lecture room; not that they are not giving attention to those things all the time, day after day. But just at the time that the lecture is given and following that is one of the best times for the demonstrators to reinforce these things as they come up in the clinic room.

If I have given a lecture and demonstrations in the placing of the rubber dam, I would like every demonstrator to give that his special attention for the next week or so. And so on with everything I do in presenting subjects to the class. I think that this serves to reinforce the work of the lecture room very powerfully.

I appreciate very keenly the difficulty of obtaining a good corps of demonstrators, efficient men. The conditions under which we work make that unusually difficult; that is, unusual as compared with other things. But for the present we must get along with that difficulty the very best way we can.

The question of consultations before patients is, I think, rightly put by Dr. Hunt. We should not refuse to consult with students or student demonstrators before the patient. In fact, the more plainly we keep it before the public or the patients who come to us that this is a school; that the students are studying dentistry, that they are studying these operations, and that consultations are the thing, the better it is for all concerned. It is better for the student, better for the demonstrator, better for the patient that these things be done.

As for the patient: The patient should know that he is under guard all the time. The work must be examined; the student must

have a written permit to operate on that patient; a written assignment, and that is his authority for undertaking any operation. You all know that the State Board of Dental Examiners does not allow persons to practice dentistry who have not passed the regular examination for license to practice. The student who goes to work on a patient without having this permit or assignment might be subject to arrest. From the time the patient enters the infirmary until he leaves both he and the student are under guard and under the care of the demonstrator or the professor, and the student does nothing without their sanction. That is a legal form and it is a form for the protection of the patient and for the instruction of the student, and every step of the work must be examined before it is passed and a record made of the whole. Next year, when it is asserted that such and such a thing was done in our school by such and such a student, even if the student is not known, we ought to be able to take it up and go through all those steps and know under whose eye this thing was done, how it was done, by whom, etc. Everything should be a matter of record so that we may know all about it.

So that this careful guarding of the patient's interests is also a careful guarding of the interests of the student, and if they do any one step of the operation that is not just right, they should be set right before they are allowed to go to the next.

Dr. H. A. Smith, Cincinnati, Ohio:

There is one thing that occurred to me while listening to this discussion as to the demonstrator. It is the announcing of a number of demonstrators by certain colleges who never appear as teachers. In fact, it has been known that demonstrators are advertised who have been dead for years. Is not this done with the view of taking an unfair advantage of colleges that are more honest in their methods and only announce the names of men who appear and serve as they are expected to by the student?

With reference to the professor being on the floor of the clinic room: I think it is possible for the professor to be on the floor too much. The students seem to lose their respect for a man who is always prowling around. When he does appear on the floor let there be a reason for it. I suggested that some years ago to the

late Dr. Menges, who, as you know, had his [illegible] infirmary floor, and he said, "By George, I never thought of that."

In regard to consultation with reference to a [illegible] in hand: You all know that the student is very sly and will come to you whether he really wants an opinion or not, hoping to get a different opinion from that which the demonstrator has given for the purpose of making mischief, and if you are not very careful you are liable to be caught in the trap. How can you avoid that? By approaching the case modestly, as any consultant ought; the conference should be conducted somewhat on the lines of a true medical consultation. Respect the doctor who has been there before you; find out, if possible, what his opinion is. Do not take a decided position until you have had a full and free conference with the demonstrator in charge of the case.

Dr. N. S. Hoff, Ann Arbor, Mich.:

This matter of abuse of a patient to which Dr. Smith referred reminds me that oftentimes patients are abused in our clinics by being disappointed in regard to their work. Students will not keep their appointment with their patients. Opportunity also occurs for abuse in connection with the crown and bridge or prosthetic work, by unnecessary delays in completing the work, or by unintentional and sometimes by intentional slights in construction. I would like to have some of our wise clinical managers tell us how they manage to keep the student in line and make them keep their appointments and not abuse the confidence of the patient.

Dr. J. Q. Byram, Indianapolis:

We have a scheme at our school that remedies the matter to which Dr. Hoff refers. We work by the point system. We have an engagement book and engagement blanks. The student makes an engagement and gives the patient a duplicate. The clerk records all engagements in the book, and if the student forgets the engagement he can refer to the book. If he failed to make a written engagement with the patient, he is held responsible; and if the patient comes and he is absent we charge him with a broken engagement. If he has a written engagement and fails to keep it he is also charged with a broken engagement. We deduct fifteen

points for each broken engagement. At the end of the year these points [illegible] deducted from his total credits.

DR. H. L. BANZHAF, Milwaukee, Wis.:

I would like to have Dr. Berry tell you what we do in our school in Milwaukee in answer to Dr. Hoff's question.

DR. F. H. BERRY, Milwaukee, Wis.:

I do not know that I can shed much light on that subject except that in my case a good deal depends, perhaps, on my own individuality by keeping a tab on the thing myself. I know what appointments the students make; I know when work ought to be ready for the patient; I try to keep in touch with the patient and know when they are coming and by keeping the different things in mind in this way we manage to get along very well.

Then I keep a sort of point record which counts either for or against the student and at the end of the year I check them up either to their credit or discredit, as the case may be. I think by letting the students know that you are keeping this record, no matter whether it is correct or not, it serves both as a check and a spur. It has an influence in keeping them busy and interested in their work. Of course, a good deal depends on the control the man at the head of the infirmary has over his students. Whatever you may devise to make them do just what they are expected to do, will be a success only in proportion to the way it is enforced.

DR. H. L. BANZHAF, Milwaukee, Wis.:

Dr. Berry is too bashful to tell you just what he does to control his students. Dr. Hoff wanted to know what the wise ones do to control the students, especially in regard to keeping their appointments. Dr. Berry has a little box nailed at the end of the infirmary and in this are placed the names of all the students who work in the infirmary. The box contains a number of brass bars on which the doctor has printed the name of the student. As a case comes in the bar at the bottom is taken out and the student whose name is on this has the case assigned to him. Then this bar is put into a drawer. Each day, in the morning, the demonstrator looks into this drawer to see just where the student is and

what he is doing. If he is not in the laboratory he immediately finds out what he is doing, and why he is not in the infirmary. In that way we keep close tab on our students.

DR. BERRY:

I did not mention this part of it because I do not call that teaching methods. It has its good effect so far as the school is concerned in getting the work out on time, but it teaches the student to be punctual in a machine way. It is not just the best method.

DR. W. E. GRANT, Louisville, Ky.:

Teaching methods in the infirmary. This subject is so broad and so important that we ought to devote a whole day to its discussion instead of only a few hours. As to the matter of teaching the student to keep his engagements. It is important to have a time limit during which the student is allowed to meet his patient, and that limit ought not to exceed fifteen minutes. That is to say, if a student has an engagement at two, and he is not there at fifteen minutes after two, the engagement is considered as being broken and the case is turned over to another student. The erring student should also be punished by giving him more work or by taking off so many points from his credits. (If you use the point system, which I heartily recommend, not only in the operative department, but in all departments, the student is graded on the point basis.) Of course, it has its disadvantages as well as its advantages.

It is not fair to the patient to turn him over to a student who is not competent to do the work. The student should, if possible, begin on simple gold fillings and simple work of all kinds. He must work gold to learn to work gold, etc., for that is the only way in which that student will ever learn, and, furthermore, the work is being done under the supervision of a corps of demonstrators so that no harm will be done the patient.

DR. GUILFORD:

That is the plan exactly that we pursue in our school. The student is allowed fifteen minutes. If he does not appear then the case is assigned to another student.

Dr. Patterson:

I would like to know how the student, who is unable to perform a certain difficult operation, is going to be taught to do this work if all such cases are referred to those students whose abiiity is unquestioned. It appears to me that this method is very unfair and partial.

Dr. J. Q. Byram, Indianapolis:

I have adopted a scheme this year which I believe will answer Dr. Patterson's question. It is a co-operation of the technic and the infirmary. As I stated a moment ago, we use the point system. I give the student points on all technic work; these points have a certain value in the infirmary. As an example: we give seven points for each practical shell crown and four points for each shell crown made in the technic laboratory. Our requirements in Junior crown and bridge work before the holidays were two molars and a bicuspid. Some Juniors have made as many as twenty technic crowns. If they are not busy in the infirmary this system encourages them to keep busy. They go to the technic laboratory in the afternoon, and if a student is wanted in the infirmary the demonstrator sends for him. The busy students are learning something.

I am also using this system in the plate work and when we have a four years' course I propose to inaugurate it in the operative tehnic department. My idea is to keep the boys busy from the time they enter school until they leave. We know that students feel that they do too much technic work; they do not see the result. By encouraging the student to do this work, and by giving him these credits, he will work, and he works in a different way, because he is anxious to have a large number of points. The poor student must work or he gets behind.

Dr. Patterson:

I allow that the technic work is exacted from them all, but it is a common practice that a certain operation is given to a certain student because he is most competent to do it. That is common practice, but it is a wrong practice. The man who can perform the operation does not need the practice as does the man who is not able to perform that particular work. I do not understand why the best operators should do all the work that is difficult of

performance. They do not need it, while the others do. It is a pernicious practice, one which should not be encouraged.

Dr. Byram:

Out of a class of sixty students there are about twenty who stand above the others. There are at least ten who are far below the other fifty. About half of the class can be placed on a level. Let us take the ten students who are not proficient, and if we give one of them a difficult operation, what is the result? In most cases the result is far from being satisfactory to the patient, student or the demonstrator. Even though we require the student to do the work over, in most cases the patient becomes dissatisfied and goes elsewhere. Patients who come to our infirmaries have other things to do besides having dental operations performed.

By requiring the poor student to work on his technic, and to do more technic than the better ones, and by giving him his points, it encourages him, and brings him up to a certain mechanical standard which will enable him to do the operation successfully.

Another point: theoretically all students should be on a level in the infirmary, but practically this is bad.

We have many patients come to the infirmary because they feel that their work will be well done. If we give these patients to inferior students we drive them away and decrease the clinic. We must build up the clinic by giving a difficult operation to the best student. He is better than the other because he is naturally more proficient. The poor student must be brought up step by step; the simpler operations first, then, finally, give him difficult work. In my opinion it is not justice to student or demonstrator to give difficult operations to the poor student until he becomes proficient.

Dr. W. E. Grant, Louisville, Ky.:

I hope that Dr. Patterson has been answered. I want to bring out this point—that dividing the class as Dr. Byram has divided it, you do ten poor students an injustice. If you pile on work that they cannot do you discourage them, and, as Dr. Byram says, you must take care of your clinic. These patients expect to get good work and they ought to get it. You cannot do as you please with them. You must build up the infirmary practice as you would build

up your own practice. You must take care of it; you must nurse it, and here efficient demonstrators will help the good work along. The point is this: If a six or eight-tooth bridge comes in, and that poor student is not competent to make a shell crown, how much harm you are doing him by assigning that case to him. Put him back on his technique.

DR. PATTERSON:

What is the purpose of the dental infirmary and dental teaching? Is it to build up an infirmary practice or to make dentists?

DR. GRANT:

Unless you have an infirmary you cannot make dentists, and for that reason you must nurse this practice if you are going to make dentists out of the best part of your class. You must not injure ninety per cent of your class in order to develop those ten poor students. Let that man go back and give him an infirmary case in which he can put on a shell crown, and put on a two-tooth bridge instead of a six or eight, which he is not competent to handle.

DR. G. V. BLACK, Chicago:

The infirmary patient generally is the patient of that particular student; at least, that is the case in our infirmary. They come for the purpose of having a particular student perform some operation upon them, just as our patients come to us in our private practice. Now, I do not want to give that patient over to some other student. I will punish that student for failing to keep his appointment in some other way. I want every student in my infirmary to be building up a practice of his own, gathering his patients around him. That is his business just as it is his business to perform the operations properly. And if it so happens that the case which is assigned to a student is too much for him, somebody must assist him. What is the demonstrator there for? Somebody must assist the student and see that the patient is properly dealt with. It is impossible for us to parcel out the assignments in exact accordance with the ability of the student. We cannot do that; we must watch over and assist those cases that fall into the hands of students who are incapable. In that way we will also guard our infirmary practice, at the same time teaching the student who is incapable.

APPENDIX — A.

LIST OF MEMBERSHIP COLLEGES WITH DULY ACCREDITED REPRESENTATIVES PRESENT, DUES PAID AND ENTITLED TO VOTE.

Northwestern University, Dental Department.
College of Dentistry, University of Minnesota.
Dental Department, Vanderbilt University.
Louisville College of Dentistry.
Royal College of Dental Surgeons.
Dental Department, Western Reserve University.
Chicago College of Dental Surgery.
Dental Department, University of Michigan.
Ohio College of Dental Surgery.
University of Iowa College of Dentistry.
Indiana Dental College.
Kansas City Dental College.
University of Buffalo, Dental Department.
Dental Department, University of Pennsylvania.
Philadelphia Dental College.
Department of Dentistry, Detroit College of Medicine.
Dental Department, Ohio Medical University.
Missouri Dental College.
Dental Department, University of Omaha.
Pittsburg Dental College.
New York College of Dentistry.
College of Dentistry, University of Illinois.
Dental Department, Medico-Chirurgical College, Philadelphia.
New Orleans College of Dentistry.
Keokuk Dental College.
Cincinnati College of Dental Surgery.
Birmingham Dental College.
Baltimore College of Dental Surgery.
Marion Sims Dental College.
Dental Department, Milwaukee Medical College.

MEMBERSHIP COLLEGES WITHOUT ACCREDITED DELEGATES.

Dental Department, University of California.
Dental Department, University of Tennessee.
Pennsylvania College of Dental Surgery.
Southern Dental College.
Atlanta Dental College.
Washington Dental College.
Total membership, 36.
Colleges represented by delegates, 30.
Colleges without delegates, 6.
Colleges admitted at this meeting, 1.

Respectfully submitted,

H. B. TILESTON,
Secretary and Treasurer.

APPENDIX—B.

Those in Attendance.

H. J. Goslee, Chicago.
L. C. Borland, Chicago.
A. H. Peck, Chicago.
J. R. Watt, Chicago.
R. C. Brophy, Chicago.
R. R. Maldson, Chicago.
C. N. Johnson, Chicago.
J. P. Buckley, Chicago.
C. E. Jones, Chicago.
F. C. Zapffe, Chicago.
B. J. Cigrand, Chicago.
F. W. Parker, Chicago.
T. W. Brophy, Chicago.
G. V. Black, Chicago.
J. D. McCauley, Chicago.
E. Noyes, Chicago.
F. B. Noyes, Chicago
J. G. Reid, Chicago.
D. M. Cattell, Chicago.
G. W. Dittmar, Chicago.
J. H. Prothero, Chicago.
G. W. Cook, Chicago.
R. W. Parker, Chicago.
J. D. Patterson, Kansas City, Mo.
H. B. Tileston, Louisville, Ky.
W. E. Grant, Louisville, Ky.
N. T. Yager, Louisville, Ky.
E. M. Keltey, Louisville, Ky.
F. L. Whitman, Louisville, Ky.
W. E. Willmott, Toronto, Ontario.
W. C. Trotter, Toronto, Ontario.
A. W. Thornton, Toronto, Ontario.
A. O. Hunt, Omaha, Neb.
F. R. Ross, Omaha, Neb.
M. C. Marshall, St. Louis, Mo.
J. H. Kennerly, St. Louis, Mo.
W. M. Bartlett, St. Louis, Mo.
H. Prinz, St. Louis, Mo.
D. Lindsley, St. Louis, Mo.
B. E. Fischer, St. Louis, Mo.
R. H. Nones, Philadelphia, Pa.
S. H. Guilford, Philadelphia, Pa.
C. R. Turner, Philadelphia, Pa.
Edwin T. Darby, Philadelphia, Pa.

H. L. Ambler, Cleveland, Ohio.
G. H. Wilson, Cleveland, Ohio.
H. C. Kenyon, Cleveland, Ohio.
W. H. Whitslar, Cleveland, Ohio.
F. C. Manchester, Cleveland, Ohio.
W. A. Price, Cleveland, Ohio.
C. V. Vignes, New Orleans, La.
H. B. Gessner, New Orleans, La.
W. C. Barrett, Buffalo, N. Y.
J. A. Sherwood, Buffalo, N. Y
W. P. Dickinson, Minneapolis, Minn.
O. A. Weiss, Minneapolis, Minn.
T. B. Hartzell, Minneapolis, Minn.
A. Owre, Minneapolis, Minn.
E. F. Hartz, Minneapolis, Minn.
J. O. Wells, Minneapolis, Minn.
J. M. Walls, Minneapolis, Minn.
G. J. Dennis, Minneapolis, Minn.
T. E. Weeks, Minneapolis, Minn.
W. B. Fulton, Birmingham, Ala.
E. Hillyer, New York, N. Y.
F. D. Weisse, New York, N. Y.
H. W. Arthur, Pittsburg, Pa.
D. R. Stubblefield, Nashville, Tenn.
H. P. Neeper, Keokuk, Iowa.
G. S. Shattuck, Detroit, Mich.
W. T. McLean, Cincinnati, Ohio.
H. A. Smith, Cincinnati, Ohio.
F. H. Berry, Milwaukee, Wis.
P. B. Wright, Milwaukee, Wis.
F. J. Wilson, Milwaukee, Wis.
H. L. Banshaf, Milwaukee, Wis.
W. G. Foster, Baltimore, Md.
J. Q. Byram, Indianapolis, Ind.
G. E. Hunt, Indianapolis, Ind.
L. P. Bethel, Kent, Ohio.
C. A. Hawley, Columbus, Ohio.
L. E. Custer, Dayton, Ohio.

W. S. Hosford, Iowa City, Iowa.
F. T. Breene, Iowa City, Iowa.
N. S. Hoff, Ann Arbor, Mich.
L. P. Hall, Ann Arbòr, Mich.
C. P. Shaw, Boston, Mass.

The Institute of Dental Pedagogics

Eleventh ?

~~Tenth~~ Annual Meeting
Held at Buffalo, N. Y.,
Dec. 28, 29 and 30, 1903.

CONTENTS

Tenth Annual Meeting of the Institute of Dental Pedagogics.

11th

Some Faults of the Prevailing Dental Training.

By J. D. Patterson, D.D.S., Kansas City, Mo.

President's address

In directing attention to this subject I must disclaim any intention to criticise without an ultimate object, and that is to assist in the correction of errors which seem to have been grafted firmly upon the system of dental education. "It is easier to be critical than to be correct," said a noted Englishman, but it must also be remembered that unless there is weakness in the thing criticised there can be no strength in the criticism.

The faults which I desire to mention and comment upon may be divided into two classes:

First: Faults fostering a low grade of professional spirit.

Second: Faults in the methods of practical and theoretical instruction.

Dentists Not Respected by the Public.

It certainly needs no argument to support the statement, when I say that the public does not accord to our calling the need of respect and honor which we believe it demands on account of the benefits it confers in giving comfort to human beings, and which it does accord to ministry, the law and to medicine. I think I am safe in asserting that

each of us has repeatedly suffered from some humiliation caused by slighting allusion to the status of the dental practitioner. Is it deserved? I think it is. Can this be corrected? I firmly believe that within a quarter of a century public opinion can be moulded aright in this matter, and I believe it is the duty, within the province, and perfectly possible, that the Institute of Dental Pedagogues can bring about the change.

In proof of this statement I place before you the following summary of facts: *In any profession its dignity and high regard in the eye of the public must ever be dependent upon the individual personal influence of each of its members.*

The public cares nothing for us save as individuals, or groups of individuals, but the individual gives the true standard of respectability of the profession to which he belongs. Now where does the responsibility lie in the selection of individuals and the moulding of them who will hereafter dominate the standard of the dental profession? Does not the responsibility lie with this association?

In these times, no one (save in isolated cases) can gain entrance to the dental ranks save through the medium of the Dental College. The faulty result of dental teaching lies either in accepting unfit students or in the faulty teaching of those students. The teachers are the ones who determine or advise what the preparatory ability of a student must be as well as guiding him after acceptance, for in no one of our colleges is the business management separate from the teaching force. You may declare that this association is solely devoted to elaboration of teaching methods and that the questions of legislation and administration lies with the Faculties Association and should not be touched upon here. In answer I will say that the divorcement of the consideration of methods of instruction from the consideration of methods of administration in my opinion is an impossibility. The segration of relafed interests in our professional advancement is unwise, and if this association is in fact, as well as name, a National one, no discussion of teaching methods is logical if prominent factors in dental education are tabooed.

Faculties Association Derelict.

Again, the National Association of Dental Faculties whose objects are supposed to be varied, among which is the subject of legislation, administration and police control over dental education, *is a legislation body which too often does not legislate; an administrative body that does not administer,* and whose requirement of obedience to rules is elastic, varied to suit the individual case. The Faculties Association in late years has made the mistake of apparently believing that better dental education is measured by increase in the length and number of courses instead of making a better selection of talent and acquirement. The prediction is

hazarded that extension of number and length of courses will tempt to accept still more of kindergarten material with the idea that the lengthened time will allow for making up deficiencies.

The desired work of improving the standard of the graduate cannot be left to that association, for it has not been faithful to its trust. I speak with all calmness and certitude, and the record will substantiate me in stating the claim that since the Faculties Association in 1897 in an illegal manner abandoned the advanced standards which it had adopted in 1896 and which advanced standards in their elaboration would unquestionably have brought a rapid advance in the professional standard in dentistry—that association cannot be credited with any advance towards making our calling dignified and professional. The average intelligence of the student in late years has not improved, and a same dead level of indifference to everything but a diploma and the money it will enable them to grasp, exhibits itself in the great majority of those we are called upon to instruct. The result is the multiplication of low grade practitioners, who in their student hours give a smile of derision when an enthusiastic teacher pleads for a high plane of living and doing in dental professional life, and whose name after graduation is found in the cheap advertising page, or as the employee of the "Dental Parlor" proprietor. As the years have gone along it has been the hope of the enthusiastic that the personelle and intelligence of students would steadily improve. To those who have carefully observed the subject the hope has died, and they turn to seek a new and different force for uplifting. The treason of 1897 and its results stamps distrust on the idea that any good along the desired lines shall come out of the wisdom of the Faculties Association.

To what agency then shall we turn in the emergency? *Undoubtedly to this Institute.* It is not my purpose to advise this body to legislate, but it can so advise and *insist upon reforms that reform will be brought about.* If each individual in this body will pledge himself to demand better material, that can be moulded into gentlemanly behavior, as well as superior, practical acquirement, there *must come a practical result.*

Count System of Credits.

Under the first heading the second error I will note is that of ignoring the Count System of Credits, both in preliminary requirements and in the actual training. This will only receive a brief attention.

It seems strange that when a perfectly feasible method of positively perfecting credits for acceptance and advancement is at hand, that it has been rejected by an almost unanimous voice in the Faculties Association in 1897, and the same fate will probably be given to the measure in 1904. We crave the careful consideration of every member of this institute to this measure and his support for its adoption in dental education,

so that credits either for preliminaries or advancement shall be *alone by merit for work accomplished* and certified to and not at the behest of individual minds or for any purpose ulterior to the best in dental education. Every member of this institute should support the movement which is again attempted, and endeavor to place dental education on the same basis of credits which has been adopted by the best literary and professional systems in the old and new world.

The Teaching of Dental Ethics.

The third fault which I notice under the first head is that our teachers do not teach professional ideas and duties sufficiently. They should make it convenient to frequently explain what constitutes a profession—why dentistry is a profession—should combat unprofessional ideas, and illustrate how degrading is their influences. It should be taught daily that no profession more demands the gentleman than ours. *This teaching should be a keynote.* There are those in our classes, who otherwise are acceptable students, but whose knowledge of the duties, and obligations pertaining to professional life is entirely wanting or at best is extremely vague. To them it must be taught and *earnestly* taught. The teacher must do this both by precept and example, for each one must remember that *"professions pass for nothing with the experienced when connected with a practice that flatly contradicts them."* The teacher by personal example then must teach professionalism. If they cannot, or will not do this, there is, in my opinion, no place for them on the lecture rostrum in the laboratories or the infirmaries of a dental school as instructors of young men who some near day must necessarily dominate the profession of our choice and by their fruits decide whether its future shall stagnate, retrograde or improve. When our eyes view the average grade of intelligence in our graduating classes of today tend the will of the duty of professional men is there not often a shiver of apprehension? The question surely demands a very careful consideration from members of this body.

The Rejection of the Unfit.

Lastly under this head we come to the fault in dental education which is presented in the fact that when dental students give positive evidence of their unfitness for the profession, they are usually encouraged to continue instead of being earnestly advised to abandon the work, or even commanded to do so. In earlier days the apprentice system did the winnowing, and the student who was unfit was so advised and discharged from the office of his preceptors. Personally I know of two such cases in the office of one of my preceptors in 1865 and 1867, and I know of other instances. This, it must I think be acknowledged is an admir-

able feature of the apprentice system and one of the reasons which has caused the writer to advocate that system as a prelude to dental college training. In the college this winnowing has not been accomplished. The student, without his own knowledge, or the knowledge of any one else, as to his fitness for dentistry, very often comes to the college from a long distance under a considerable expense, with ideas undefined except as to the curious belief that dentistry affords *"an easy way to make money,"* and when he finds himself mistaken it is usually impossible or impracticable to recede, for money has been expended and the expectation of relatives and friends must not be disappointed. He must "Willy Nilly" proceed. He does so, and the profession is burdened with his compelled presence. Every teacher in this association should *strongly* advise the unfit student at the earliest possible time to seek other avenues of life work, even if it is at considerable sacrifice. The apprentice system is evidently impossible as a compulsory measure in this country; the sentiment is, I think, strangely against it; therefore, if a student leaves the work after entering college, it will be by the teacher's advice. I *counsel to give such advice.* If it is given through correct motives and on unmistaken evidence, it will, I assure you, usually be followed, and the teacher will thus do his share to mitigate this faulty and unfortunate situation.

Diverse Teaching in College Courses.

Under the second head of this division of our subject we come to the fault found in the lack of co-operation and uniformity in methods between lecturers and demonstrators. In the major part of teaching there is a standard which should admit of little variation or at least of unimportant variation, but we are confronted with the fact that the lecturer advises certain lines of practical procedure or gives a theory which in the laboratory or infirmary is diametrically opposed or seriously modified by the demonstrator. So has arisen much confusion and has lead the student to uncertain results. Such is not the case when the professor superintends in the infirmary what is said from the lecture stand, but personal observation teaches that very, very often the lecturer is not a visitor to the infirmary or the laboratory, and those demonstrating do not harmonize with what has been said from the lecture stand.

Again, different demonstrators recommend and direct opposite procedures when only one method should prevail. This fault should be corrected by the selection of only experienced teachers—and frequent faculty meetings in which the teaching should be so far as possible along uniform lines. This brings us to the fault of employing men as teachers and demonstrators who are of indifferent skill and limited experience, and who are secured at a salary which never can obtain the best service.

Lack of Demonstration.

The next fault we notice, and a most noticeable and direful one, is a too limited number of demonstrators in laboratory and infirmary. The instruction and detail in practical work can never receive the necessary supervision which is due the student and which is absolutely necessary while one demonstrator has under him so many pupils and so many operations which demand his attention in the same hour. Personal experience and close observation convinces me that this fault is most serious. I have never entered laboratory or infirmary in the college which I am connected, or in those of other schools members of this association, but I am confronted with this fault. Each demonstrator in the busy hours on account of the number of students under him has so many demands upon him that if he devotes necessary time to a few, the many are neglected, and if he endeavors to direct all, he does it so imperfectly and hastily that nothing is done satisfactorily either to himself—the student, or the patient. I hear you say that this is well known and admitted, but why find fault unless a remedy is offered? Very true—the criticism lies—but I do propose a remedy and the remedy must be in increasing the tuition fees so that additional and experienced teachers may be provided.

College Fees Should Be Increased.

These faults last noticed, viz.: employing as teachers men of indifferent skill and limited experience; who can be secured at a low salary; and upon whom we place work enough for double the number, can only be remedied by securing the means requisite to employ the best skill, matured by wide experience, and in number sufficient to thoroughly supervise and direct each student.

Is the means now at hand? I think not. Experience has taught me that usually the colleges have provided as many and as expensive teachers as the dues paid will permit. Those who think differently are usually those without experience in the financial affairs of dental colleges. This being true, what other remedy have you to offer. The best teaching talent *cannot* be secured in these days without competent remuneration—their number *cannot* be increased without the increased income. Let us provide the means. Let us relegate the under graduate and the recent graduate teacher to where he belongs—to the world of experience and give to those competent men who now teach, a proper fee and secure others of talent and experience to assist them.

I therefore bespeak the effort of each individual in this institute to a sufficient increase in tuition fees. I believe a united effort would convince all concerned that this can be done, and that it would be a step in advance of greater benefit than adding another year to the course. The

foreign dental schools of prominence usually receive a fee of £50 per term, nearly $250 of our currency, and their expenses are less because they do not require the equipment for practical work which is so expensive, as their students receive that instruction under their preceptors to whom they are indentured. Why should we not profit by their example in this matter of tuition? At any early period in the history of dental education when teachers, many of them engaged in teaching without money recompense because they deemed it a professional duty to instruct new men to meet the great need of dental service, and when students were not so numerous, the fees for tuition were placed at a nominal sum. It was all that was required at that time--the fault has been that they have not increased with the demands of the day, which compels larger outlay for competent dental instruction. The salary list of the really competent demonstrators who give the college a larger portion of their time in every college I have investigated, is grossly inadequate and the position is not retained long by them and is used as a "pot boiler." This is a fault. The salary of the competent should be commensurate with a dignified position. Of the *incompetent* and inexperienced what shall I say? College men declare that they are unable to avoid their employment; that they cannot afford to pay the best men very well. Let us concede that this is true, and let us rapidly place ourselves in a position to afford the best, for of all departments of dental teaching the demonstrator is the one who should without exception be at the front rank.

At the last annual meeting of this Institute, Dr. E. J. Darby made a statement which created something of a sensation. He said, referring to the earlier dental college training, "*We made better dentists then than now.*" He referred to the practical work then and now. The observation was made by a careful man who had no remote idea of stating anything but what expereince and observation warranted. I think the statement true and that the older men of this association must subscribe to Dr. Darby's opinion. Personal observation and contact has taught the writer the utter helplessness of the majority of students who have come to the end of their college course—when confronted with practical cases a little out of the ordinary. What has caused this condition? Is it not caused by some of the faults above noted? In early years when the student came up for graduation at the end of one or two years, he almost invariably came to the college with practical experience, gained from a private pupilage usually, and this advancement has not found its prototype in college training. The college has failed to "make good" in this matter. Students are herded together, known by a number. The shepherds are too few and many of them incompetent, and that personal supervision which is so ncessary in a calling which is so largely mechanical and which re-

quires personal and repeated direction for the attainment of manipulative dexterity has not been afforded. The question is certainly a vital one. If the college training in any department is sending out a product inferior to that of past years, it is certainly time to make a reckoning and find the fault. Is the practical instruction deficient? The theoretic curriculum too burdened? or the student of such inferior moulds that the finished product is misshapen? These are questions for this Institute; they will not be settled elsewhere.

In concluding I thank you for the honor you have given me in electing me to the highest office in this association. I am very jealous of the distinction. I hope that our conferences at this annual meeting will result in improvement individually and collectively.

Discussion.

Dr. R. H. Hofheinz, Rochester, N. Y.

The question of education will always remain a fruitful text for unlimited discussion for any gathering of this kind.

I have been asked to discuss the paper of our worthy President, but after looking over the epitome he sent I could find little to discuss. My views coincide so much with Dr. Patterson's that I can only reiterate his opinions and recommendations in my own language.

The Doctor divides his paper into two great halves: The deficiencies which arise (1) from a lack of education before entering college; (2) from faulty instructions after having entered college.

To accept students of inferior preliminary education is the greatest fault I can find with all our dental educational systems. This question alone should suffice for a good long essay. No additional years of college or university teaching can compensate for the defectiveness of early intellectual training.

The Germans demand nine years of Gymnasium before they consider the mind ripe for university lectures. The introduction of a four years' university course can never compensate for early deficiencies. The mind must have proper shaping in youth to form an intellectual storage battery for our university teachings, and I am almost inclined to think it more important for dental students than for any other. Most of the scientific studies require a cerebral effort only; whereas, in our case, the manual, the technical development consumes much of our college time. It is the early part of life which is a period of plasticity, a period of adjustment—of a physical adjustment—and then an adjustment on a larger and broader scale.

N. M. Butler says: "There are in the United States no obstacles interposed between the college and the university. We make it very easy to pass from the one to the other; the custom is to accept any college degree for just what it means. We make it equally easy to pass from one grade, or class, to another, and from elementary school to secondary school. The barrier between secondary school and college is the only one that we insist upon retaining."

Gentlemen, it is, however, not only the quantity of preliminary knowledge which proves a telling factor in our dental education; it is the quality which our president has well emphasized.

Three years ago I chose this question for a paper before the National Dental Society. My opinion on this subject remains unchanged and I take the liberty to quote from aforesaid paper:

Manual Training.

"I make the broad statement that a student who under favorable conditions has not developed some manual skill at the age of eighteen—the time for college entrance—does not possess the physical requisities of a good dental operator. In my estimation we should be in position to judge the physical the same as the mental equipment of the dental student previous to college entrance. The student who is not naturally endowed with a reasonable amount of manual ability will never become the dental operator so much needed."

Manual dexterity is but the evidence of a certain kind of mental power, and it should go hand in hand in its early development with that of the mind. This education belongs to the secondary schools, and if this quality is insisted upon as a preliminary requisite, the possibility of unfitness during college life, of which Dr. Patterson speaks, is reduced to a minimum.

Professional Ethics.

Much stress is laid in Dr. Patterson's paper upon the fact that professional ideas are not sufficiently taught in colleges; that the teachers are lacking in the proper spirit of directing the students toward professional honor and ethics. I am of the opinion that you may teach ethics in dental colleges to a large number of students until Doom's day without accomplishing the desired result.

Why? Professional instinct, reverence for scientific achievements, the proper feeling for ethical culture, belong largely to early home training and proper, elevating environments outside of a college. The young man, endowed by Nature with a spirit of commercialism, the predominating characteristic of our time, can never grasp the meaning of professional refinement at the age of twenty, no more than the man who enjoyed "rag time" music only, up to that time, can ever really appreciate

the celestial meaning of a Beethoven adagio. The wrong in this direction is usually done, and permanently done, before the student enters a dental college. This, however, does not deny the necessity of ethical teaching in our colleges, and I should consider myself very inefficient in performing my duty, did I not constantly endeavor to lead the student's mind to a proper and correct understanding of professional honor.

There is no better mode of showing proper professionalism to the students than the conduct of your own practice. This is the best object lesson you can give students at that time of life. Nothing will impress the students with a higher regard for professional loftiness than the success which a teacher has to show through the application of these very principles.

All teachings of ethics in the lecture room smack of absurdity and lack sincerity, if not properly sustained by the teacher's own methods in practice. The man who cannot show through his own conduct in life the very pathway to ethical professional success, has no moral right to pose as a teacher.

Demonstrators. The other great fault Dr. Patterson finds in college teaching is the inefficient number, and, often, poor quality of demonstrators. This is certainly a most vital question. A large number of our dental colleges are without endowments, and therefore exclusively dependent upon the income from the students, a condition which necessitates economy and very often in the wrong place.

I would rather have one competent demonstrator in my infirmary than half a dozen incompetent ones. I have often endeavored to settle the relative necessity of one demonstrator to a certain amount of students, but I found it impossible, owing to the difference in the quality of students which each class presents. The consensus of opinion of our demonstrators and myself is, one demonstrator to ten students. I have repeatedly seen one student able to keep all the demonstrators busy which our university could furnish.

There is but one ideal way of teaching, and that is to study the individuality of your student and teach according to its demands. If I were rich enough I should create a fund for that purpose and prove to you results such as Froebel has given to the world in his kindergarten system. I never have and never will permit any difference of infirmary practice from my method of didactic teaching. Dentistry is not a very broad profession, but it certainly permits numerous ways of execution. It is utterly impossible, without confusing the minds of beginners, to teach definitely more than one system, and that should be one based on successful and progressive methods. Other operative methods

should be alluded to and teaching should thus be cosmopolitanized, but neither the mind nor the hand of a student should be allowed to wander in all directions, without a positive method, which must prove the foundation for all possible future ramifications.

If what Dr. Darby said is true, that "We made better dentists then than now," it is our duty to find the cause of such retrogression. The proper way to reach that end is by such frank presentations of our faulty methods as Dr. Patterson has given us, and by intelligent criticism of such faults.

No profession has made such wonderful progress in a short time as ours. A time for proper assimilation is needed, after which we will replace that statement of Dr. Darby's by one which will tell the world that we are making better dentists now than ever.

Dr. John I. Hart, New York City.

We are extremely fortunate in the character of address just delivered by our President. He has abandoned the conventional and blazed a new field of his own. He has handled the subject of high ideals in a manner essentially practical and I for one feel deeply indebted to him.

No system is so perfect but that it is susceptible of improvement. The fact that this body of busy men congregate here for no other purpose than the advancement and elevation of dental education is an encouragement in itself, and the most pessimistic must admit that if faults exist they have only to be recognized and their causes defined to lead to their correction.

The main difficulty lies in agreeing as to these causes.

In the last few years we have departed so rapidly and radically from early methods of dental education that practically a student of today is trained in a manner along fundamentally different lines from those which formerly existed. That this is not entirely satisfactory those who agree with the address just read must admit. Formerly, prospective dentists were received as students in an office for a certain period of time prior to entering college. This method possessed two advantages; it enabled the experienced practitioner to observe manual weaknesses in the student and to tell him and those interested in him of the advisability of his choosing another calling. It also gave the student more and greater individuality than is possible today. In this way the weeding process commenced before the student was committeed to dentistry as his permanent life work.

Need of Manual Training.

The number of students precludes the possibility of continuing on these lines and present methods of education have supplanted the older ones, but it throws a responsibility on dental educators which they must not and cannot shirk. Your essayist says truly that the

first fault is in accepting students of inferior preliminary requirements. This proposition must be regarded in its broadest sense; we are hide bound as to the prospective student's minimum literary education, but nothing is said as to his or her manual dexterity. So long as the standard of admission into the educational department of a profession which is mechanical as well as theoretical is purely literary, so long will we have a large proportion of disappointments and failures. I would rather teach a student of ordinary literary ability, but trained manually, than a Master of Arts with no manual training. With as much reason should a professor of chemistry be expected to teach a student arithmetic so that he should be able to work out a chemical equation, as that the departments of operative and prosthetic dentistry should be required to find out, after a student has been duly entered, whether he has the manual ability to perform his required work. No extension of the number or length of courses will stand in lieu of entrance requirements.

The records of our school will show that we have in several instances advised students against continuing to study dentistry, and in some instances absolutely refused to permit them to continue with us, but how much loss and chagrin could have been saved them, if, instead of finding this out after a waste of time and money they had been stopped at the threshold. I suggest that we require evidence of manual as well as mental training before accepting dental students.

If we can prepare individuals more thoroughly, we will have less ground for fear that they will go wrong ethically. A student who has spent three years acquiring a dental diploma and is then unsuccessful in practice building, has not the moral courage to enter another calling, but, unfortunately, is attracted by methods which he may abhor.

Ray Stannard Baker says truthfully: "The difficulty with constitutions and by-laws is that they regulate everything except human nature." Our difficulty in bringing up students to be ethical practitioners is twofold. In some instances the influences of their early environment must be overcome, in others, the mismanagement they see in the infirmary is more than an offset to their theoretical training. I believe in example even more than in precept, and feel if our infirmaries are conducted along ethical lines it will have a more lasting influence than preaching alone will effect. In our school we have found that we can more thoroughly train our students by subclass work. This is carried out in all branches of prosthetic and operative work, and no student is permitted to do any work on patients until he has satisfactorily performed similar operations in subclass. This gives opportunity for more thorough training and greater confidence than can be acquired by chair or table training alone. We have secured co-operation between lecturers and demonstrators by frequent

meetings between the two forces and a full discussion as to theories and methods. I am firmly convinced, if we examine our timber more carefully *before* admission, we will practically correct, if not entirely cure most of the evils enumerated.

Dr. Frank L. Platt, San Francisco, Cal. I feel that all of us who are earnestly and honestly interested in dental education must commend the sentiments expressed in this able address, and I feel that the faults which have been enumerated are most critical and important to us today. It seemed to me that the essayist hit the nail on the head when he spoke of the better results which might be attained by demanding higher preliminary requirements rather than lengthening the course of study; also when he recommended that many students should be dismissed before finishing the course. These two items embody a great many of the faults of our present system of dental education. The fact he mentioned of insufficient fees being paid to employ able demonstrators is another fault; but how many colleges have the courage to take up the work and correct the faults to which the essayist has called attention? The dental profession is strong enough and big enough to stand for what we know is right and have the courage to put into operation. There must be a reform, and I believe even the requirements that we have today are not being lived up to by some of the so-called leading colleges. I am from a city where we come in contact with a great many students from all over the country, and many of them appeal to me for advice. Within the last two years one young man, a graduate from one of the leading colleges, came to me with such a remark as this: "Doctor, if I had knew the conditions out here I would not have came." Do you mean to tell me that in such cases as this the colleges live up to the requirements which they are supposed to demand? I have watched that man. He is a clean, honest, bright, hard-working boy, and deserves a great deal of credit for what he has done, but he will never take tke place in dentistry which he might have taken had a good education been required of him before he entered college. I am lecturing to students today who are not what they should be along educational lines. I have in mind now one student who is deficient in this respect; and if he does not do better soon, I shall advise him before the end of the session to take up something else. He is a good, honest student, but he lacks manual dexterity and artistic sense, and seems to have no inventive genius at all. Such steps as this must be taken to stop the multiplication of glittering electric signs that we see on our streets. We will need to begin at the beginning and make students what they should be at the start. If we could demand at the outset a degree in arts or letters from a university and in addition to that a diploma from a school of manual training, we would have students who

would amount to something when they get out of school. My own personal idea is that too many of the colleges are influenced in accepting students by the fact that they think they must live. Most dental colleges are private corporations whose faculties are paid by the fees of the students, and there is a strong tendency to accept students if they present reasonably good certificates, and hope that they will be an honor to the profession when they get through. If each dental college could be an integral part of a university with expenses paid, as are those of the other departments, then we could afford, and would afford, to reject students who are deficient along these lines. I have asked the deans of five of the leading colleges what percentage of the students in their schools would make successful dentists, and not one of them said over thirty-five per cent. That is nothing to be proud of, and I am not proud of such a condition. I feel that these questions are important and should be carefully considered by this body, and that every college represented should have the courage to put into effect the reforms which the essayist has mentioned.

Dr. Geo. E. Hunt, Indianapolis, Ind.

Dr. Patterson always has something to say, and when he says it we never are at a loss to know what he means. In this paper he has told us what he means in a very forcible and effective manner. But I do not agree with him absolutely in all his statements. He divided the faults which he considered into faults fostering a low grade of professionalism and faults along the line of practical instruction.

Ethics.

Under the first division he claims that the fact that students are accepted by our colleges with inferior preliminary requirements fosters the low grade of professionalism that exists in the dental profession. I doubt that. I do not believe that the preliminary education of the student has much to do with ethical practice. I think if it is in a man to be a blackguard he will be one, no matter whether he be a college graduate or not. His preliminary educational requirements will not influence him in that respect. On the contrary, if a man is going to be a blackguard in his practice, he is more likely to be a dangerous one if he has had the advantage of college education and the training that goes with it than the man who has not enjoyed those advantages. I think that those matters rest with the individual. A person possessing very inferior preliminary educational requirements may make a very fine man ethically; that is, leaving aside everything except his professional relations with his fellow man.

The Count System.

In the matter of the count system I agree with the essayist. The count system should be adopted by us. If a man gets his points legitimately, they are his; they cannot be taken away from him, and he is entitled to his time

credits for them. As our rules are today, the man who comes within a week or two of graduating from the best medical college in the country is compelled to enter the freshman year in our dental schools and receive credit only for the actual work done. He does not receive any time credit for the years spent in the medical school. If he enters our institutions with the necessary information in histology, physiology, anatomy and chemistry, we may say to him that he is excused from taking these subjects. Then he says, "What will I do in the time that my fellow students, who have not had the advantages that I enjoyed, are getting this information." And we tell him to twiddle his thumbs. Under the count system we could give him the credits to which he is entitled.

Discouraging Students.

With regard to telling a student to quit the study of dentistry if he does not develop well during his first year at school: Theoretically that seems to be a reasonable proposition, but practically it sometimes would work a great hardship on the student. That statement by the essayist has been concurred in by everyone who has spoken previously, but I do not agree with it *in toto*. Our freshman students frequently come to us after having been out of student life for several years. They have lost the habits of study to some extent and these must be acquired once more. My experience during thirteen years of teaching has been that men who do not do well in their theoretical work during the first year frequently do very well in the second and third years, after having again acquired the habits of study lost from disuse. You all can recall men who did not exhibit much mechanical ability in the first few months of their college career, but who by persistence and industry acquired a considerable degree of skill. They often turn out to be better men than those who promised well during the first few months.

Of course, there are men so extremely deficient in manipulative ability and in gray matter that they should not attend school after their first year. Those men could be eliminated with advantage to themselves, to the college and to the profession.

The essayist gives the remedy for the lack of uniformity between lecturers and demonstrators. If these two gentlemen will meet and discuss matters, there will be no trouble about uniformity. Or, better still, the lecturer on operative and prosthetic dentistry ought to spend a certain amount of time in the infirmary in actual contact with the students while they are at this work.

I am not at all pessimistic about these faults being corrected. I think they will be.

Dr. S. H. Guilford, Philadelphia, Pa.

In regard to the qualifications of students: I do not know whether the laws with reference to the preliminary education are carried out faithfully in all the States, but I know that they are in Pennsylvania, and I presume they are in Missouri. We have adopted the plan of the State of Missouri, which requires that all preliminary qualifications shall be passed upon by a State official, so that under these circumstances there can be no question as to whether the student who enters the dental college possesses the proper qualifications. I do not see why all the colleges do not carry out this plan inasmuch as it was adopted by the faculties association. If the rule is not being adhered to in any State, the matter should be looked into and changed. When a student has once passed the examinations conducted by a State official, there can be no question in regard to his fitness to enter upon the study of dentistry.

Classification of Students.

In our dental colleges we have three classes of students: First, those who have had a very liberal education; they have fine minds and are good students, but are lacking somewhat in mechanical ability. The second class is composed of men who, perhaps, have superior mechanical ability or manual dexterity, but who are lacking in general education. Then we have the third class, the smallest of all, composed of those students who have had a liberal education and at the same time possess very decided mechanical ability. We meet this latter class occasionally, but not so often as we should like.

The question is, What are we to do with these men? It is very hard to take a man with a good general education but lacking in manual dexterity and turn him out, because those men sometimes develop very nicely afterwards. It is almost impossible to determine during the first two months whether a man will develop any manual dexterity.

Then there are those men who are skilful with their hands and who will make good operators, but are somewhat lacking in general education. What are we to do with them? They are men who will become excellent dentists, and although they may not be shining lights, they will serve the community well.

While it is desirable to have the best class of men enter dentistry, men who are well educated and who have the mechanical ability, we know that we cannot have all of our students in that class, nor even as many as we should like. Under these circumstances it seems to me that we ought to be a little lenient with the men who have practical ability but lack the higher education. By higher education I mean going through high school and college. These men often spell incorrectly and sometimes make lapses in their expressions. They annoy us, yet we feel sorry for them; but if

they serve the community well, is not that the first essential? We are not aiming to turn out polished gentlemen, but men who will serve the public acceptably in their line of work. It seems to me that we should encourage these men in every way possible and see to it that they are turned out as good workmen as possible.

Fees. Another point is the question of fees. Every dental college or any other institution must have the wherewithal to conduct its business. In other words, no college can be managed without money, and the income of the college must be sufficient to pay its running expenses. Of late years we have been increasing certain parts of our curriculum. We have been adding laboratories, broadening out in various ways, increasing our expenses enormously, but at the same time we have been receiving the same fees that we have had for the last twenty-five years. It would seem that the time has come for us to make a change. If we want to continue giving good service, we must have more money. This is not a commercial matter in any sense, but a question of finance. There is no reason why we should be expected to broaden and increase our facilities for the acquisition of knowledge unless we get better paid for it. This is a question that must be met.

As the essayist said, one of our greatest difficulties is to provide suitable men for teaching; not, perhaps, as professors, but as demonstrators. Any one who has been at the head of an institution for any length of time knows that it is difficult to obtain competent men to fill positions in the laboratories and in the infirmary. We must get experienced men, and they expect to be paid good salaries. In our school we may not have as good demonstrators as we should like to have, but we have the best we can get, and we have to pay them well for their services; and, more than that, we have to pay them more every year. Therefore, our expenses are increasing although our fees have not been advanced. It is not so much a question of lengthening the college courses as of extending them and making them more serviceable, and we can do that only by getting the best of help and plenty of it. The only way in which this can be done is by increasing our fees for tuition.

Dr. W. C. Reeves, Chicago, Ill. There are many features of the address that I heartily endorse. I do not remember that one aspect of preliminary requirements ever was brought up before, yet it is one that is of great importance, and I speak now so that others may express their opinions in this matter. There ought to be a minimum age limit. It seems to me that many students enter college too young; they are too immature to enter on their life's work. Students who enter college after having completed a high school

course and after having had a few years of a business training are more settled in their ways; they know what they are doing and they appreciate more the advantages that the college offers them. When they graduate from college they will be better dentists and will be more successful men in their profession.

Dr. Edward C. Kirk, Philadelphia, Pa.

I have listened with a great deal of interest to the address of our president and also to the words that have been spoken by the several gentlemen who have participated in the discussion. On the whole I agree with all that has been said, but I want to emphasize two points so that we shall not forget them. I was interested particularly in the remarks of Dr. Platt with reference to the faulty English of one of our good schools. I have given this matter a great deal of thought recently, and I believe that the fault lies in the school preparatory system. I think they are defective in their teaching of English. It has been my experience that the men who come to us from abroad know their mother tongue more intimately than do the men of the same educational grade in this country.

Lack of Knowledge of the English Language.

I have taken up this subject with the department of public education in Pennsylvania after having observed the educational training in New York, New Jersey and the New England States. Those of you who can look back to the same period of school training to which I belong will remember that we were given a text-book on etymology, a sort of substitute for Latin. That etymology considered so much of Latin as was applicable directly to the English tongue. It did not give us a competent knowledge of Latin, but it gave us the root words and all the English words derived from those roots, so that we got a fair knowledge of the relation between Latin and English. We obtained by that method a more intimate knowledge of English than do our students of the present under the new system which has substituted a meager course in Latin for the old etymology. The students now get a year or two of systematic Latin, but it has been found by practical experience that that much Latin is insufficient to throw much light upon English; not as much as did the old-time etymology. The present method of preparatory teaching is faulty in that regard.

In the collegiate department of the University of Pennsylvania a man today passes an entrance examination the basis of which, I think you will all agree, is not easy. It is beyond the ordinary standard of high school graduation. In the chemical laboratory of the department of arts a man was given some experiments to carry out by himself. He halted in his work, and the demonstrator seeing him looking over the bottles on the

rack asked him what was the matter. The student told him that he could not perform a certain experiment. The directions for experiment were about as follows: "Take mercuric oxide and some other substance; agitate and note the result." And the man looking among the bottles said that he could not find any "agitate." If that had happened in the department of dentistry it would have been taken as an evidence of the low grade of material that had been accepted.

The specimens of English that I secured from the New York, New Jersey and Pennsylvania preparatory schools were often abominable. It is heartrending to have to stand up in front of such men and see how little they know of their mother tongue. But the faults in English are not to be taken as representing a low grade of culture all around, not a lack of early training, beeause a student knows other things that are, in a measure, an offset to his faulty knowledge of English. We need a better training in English. Any man who does not know a foreign tongue does not know his own.

Another illustration: One of the professors was lecturing to his class in biology. He drew a distinction between the meaning of food as ingested and as applied by the cell. He gave the Latin derivation of ingesta, and then he referred to egesta, and there was not a man in the class who was able to tell him what that meant. If that man had studied etymology and knew something about prefixes he would have been able to frame his own definition of the meaning of egesta as soon as he heard the word.

Lengthening the Curriculum.

Another feature of the paper that has been alluded to is the question of broadening and lengthening the curriculum. It all hinges about the position of my colleague, Dr. Darby, who said that we made better dentists then than now. To make a dentist we must have not only the manipulative skill and ability, but we must also have a certain training in the scientific foundation of dentistry. We have added to the course chemistry, pathology, bacteriology, physiology, anatomy, etc. Do we need those or not? Is that part of the equipment of the dentist? If we do not mean that, let us all be honest and drop them from our curriculum. Let us also drop our dental degree and call ourselves master of mechanics, not doctors of dental surgery. Do we mean that those studies shall be a part of the working equipment of the professional man? Must he have them? I think he must. But in the effort to adjust these two things possibly the manipulative side has suffered. Yet, under present conditions, one or the other must suffer. If we give more attention, more time, to the manipulative side and do all we ought to do, then we are sending out men who have only a smattering of the theoretical subjects. We are giving our men about the same work in these subjects that the average

college graduate gets in Latin or any foreign tongue. He may be able to read easy prose, but it is as much as he can do to order a meal; it is beyond him to converse in the foreign tongue.

Now, how many men in dentistry today are eminent for their knowledge of chemistry? I think you would stop at half a dozen. How many great pathologists have we? What has been done to settle the pathology of pyorrhœa alveolaris? This is before us all the time, and if we had more men properly trained in pathology those things would be settled; and so it is with many other things.

As to the question of professional status: Is there any other basis on which we can proceed? Is there any other thing that will give us professional status except the professional education of this craft? The profession must recognize that principle. It is not so much a question of addition of new studies as it is of better training in the old studies. If you can make a good dental practitioner in less time than it takes to make a master plumber, why do it, but I think that if we want to get professionally trained men we must do better.

Fees.

Now, as to the financial side of this question. I agree with the proposition that we should be well paid for our services. I have always been in sympathy with the position of the Widow Bedotte, who said that "The barber was worthy of his hair." In order to manage a dental college or any educational institution properly we must have money. It has been said that one way to do this is to raise the fee. I do not believe that that is the best way. There is another way, and that is to cut down the dividends accruing to the people who divide the surplus. My mind reverts to the possibility that our sympathy with this lame student who has been mentioned, the man who gives us little promise of success and much of failure, would be less if he were not worth one hundred dollars each year. If our fees were raised we would, perhaps, be still more sympathetic toward him.

There is one other matter upon which I would like to hear some expression of opinion. I am utterly unable to understand the position our president has taken with reference to one thing, that is his somewhat pessimistic view with reference to any of these reforms taking place through the Faculties Association, and his hope that they may take place through this Institute. It is strange there should be such different 'twixt tweedledum and tweedledee. If this is not the Faculties' Association, what is it? We represent the educational interests of this country, and we are the ones who must take hold of these problems and solve them for the profession.

Dr. B. J. Cigrand, Chicago, Ill. I enjoyed this address very much and for two reasons: First, because the author dealt with the subject in a fearless manner; and, secondly, it was a criticism rather than a question of fault finding. A criticism, when properly directed, is always a benefit, and we ought to take advantage of the situation, especially because this criticism comes from our president, a man of experience, who realizes fully what is needed most and what will do good. I desire to call attention to the fact that I believe it is universal throughout all educational institutions of this country that more attention is being given to manual work. The States of Illinois, Wisconsin and Massachusetts are cutting down the theoretical work in the public schools and are giving more attention to manual training. If we will take the cue from this and cut down on the theory, incorporating this in our curriculum, we will get better results. At present we are devoting too much time to the cut-and-dried theoretical subjects, when we ought to be giving more time to the subjects that beget dexterity. We have hitched more to our courses than we can handle; and if Dr. Darby's statement made a year ago at the Chicago meeting is correct, that better dentists were made years ago than now, it is because of the fact that we had less studies then and the students were kept in closer contact with dentistry. They received better dental training. They spent most of their time in the laboratories. Today, on the other hand, very little time is given to the laboratories. I have looked into that question and I believe I am correct when I say that proportionately we are giving less time to our laboratories today than we did five or six years ago.

Preliminary Education. As regards preliminary education: I believe we ought to have a course of probation of one year; not enter the student into the course at all, but enter him into a probationary course; and if he does not develop along the line of manual training, if he does not show that he possesses digital dexterity, tell him that he ought not to continue with the work. I have stopped a few students myself, and I have advised them to go into law or into the ministry. One man has done very well in the law, whereas he would never have made a good dentist. They do not need any digital dexterity in law, and consequently they make a success of it. In dentistry you must have mechanical ingenuity or you cannot get along.

Ralph Waldo Emerson was an excellent poet. He says he would have been a positive failure as a carpenter because he was unable to shingle a roof without splitting seven shingles out of every ten. He realized his deficiencies. That is what we must realize. When a boy cannot do with his fingers what his mind dictates, he is a failure. Old Lavater told us years ago that a man can be anything that his mind desires. But Ruskin

said that mind can never do what fingers will not do. Many of us may have the desire to be pianists or harpists, yet how few could really gratify that desire or carry it out?

The Music School of Munich will take in a man prepared to come into the school, but put him on probation for one year. He is not recognized as a student in the school, but is simply a probationer. If he does not make the required progress he is not admitted as a student, no matter where he comes from. We ought to copy institutions of that kind if we are honest in our statement that we are striving to benefit humanity. Again, if you are going to put out some failures, men who do not seem to have the necessary preliminary requirements at the time, you are going to work a hardship. Where would George Washington be if you expected of the general of the army that he spell correctly twenty words? In the same letter he would spell differently the same word if it occurred twice. Therefore, I say, we must not be too severe and exact too great an education. But at the same time we should insist, first and foremost, that the student have some digital training.

Dr. Patterson. If the thoughts I had mentioned and the remedies I suggested had been attacked more I would have something to say; but as it is I can add but little to what has already been said. Dr. Hunt spoke about the educational failure, the biggest rascal of them all; and deep down in Dr. Hunt's own mind he knows, and knows full well, that so far as the majority is concerned—and it is the majority and not the individual instance that we must consider—the best dentists, the best men, the best professional gentlemen, are made out of those who have the best preliminary education.

Dr. Guilford said that we must be lenient with the men who suffered from a disadvantage in their early education or culture because sometimes they made admirable men to minister to the relief and add to the comfort of human beings in the practice of dentistry. It was right to be lenient in the days when we did not have enough dental practitioners, but today his argument will not hold good. And this argument is one that has placed the dental profession on the plane that it occupies today and against which the larger portion of my paper argued. Our present status is where we have placed it on account of that leniency; and it is not necessary to do it any longer. When it comes down to a last analysis his argument is a very poor one, and we must select the material, even if sometimes the best educated man makes the biggest rascal, else we will continue to occupy that dead indifferent level which we have occupied so long. We do not want men in our profession who will lower the status of the whole—men "who eat with their knives." We must get away from that and that is all there is about it.

I would like to say a great many things, but it would chiefly be a repetition of what I said in the address; and, in conclusion, I wish to thank you for your kindly reception of what I have said. There is nothing in the paper but what I have become convinced is true from long and close practical observation and experience. Each week as I have gone before my classes for the last twenty years, when I beg and plead for a high plane of professionalism in order that our profession may have a better standard, what do I see? An almost total indifference to the high ideals and professional duties that boys and men ought to be instructed in. They do not care about it. When we get that class of men we must drive that spirit of indifference and apathy out of them or refuse them a dental education.

The Dental Curriculum.

By George Edwin Hunt, M.D., D.D.S., Indianapolis, Ind.

When the Chairman of your Executive Committee requested me to write a paper on this subject, he informed me that the late William C. Barrett was to have been our essayist. In appearing before you as a substitute for that masterful, vigorous personality I feel that no apology is necessary beyond the simple statement that I knew him, and knew him well. Nothing but my high regard for this body and my sincere belief that your kind indulgence would cover my shortcomings with the mantle of charity, could have induced me to assume a position where comparison is so obviously to my disadvantage.

The Four Year Course.

Prior to taking up the subject matter of my paper it may be well for me to clearly define my views regarding the four year course in order that you may have my view-point. When the resolution for the four year course came up for passage, I voted "aye" in the sincere belief that it was a desirable advance calling for the support of all interested in striving for the highest educational ideals. I am frank to say that my position was taken without mature reflection and I have no excuse to offer. In the spring of 1903 the question of arrangement of a four year curriculum demanded my serious attention, and a few weeks consideration of the matter convinced me that the added year is a mistake. The intervening months have but confirmed me in that opinion. I am well aware that opposition to the four year course will meet with the condemnation of many in the profession, and I only ask those who do not indorse my con-

clusion to let my past record on educational legislation be the warrant for my honesty of purpose in this argument.

The all important question in considering the continuance of a four year course is naturally, do we need the extra year? To that query I unhesitatingly reply, No! If this contention cannot be sustained, the whole fabric of opposition falls to the ground. If it can be sustained, we have made an error which should be rectified.

Under the three year course, the majority of our colleges offered exclusive of holidays and examination weeks, seventy-eight weeks of actual didactic and laboratory instruction and one hundred and four weeks of infirmary work. The hours of work were not unusually long, nor was the work unusually hard. Public school pupils spend as much time each day for *nine* months in each year, at their educational tasks. No one can successfully contend that dental students were overworked. On the contrary, the brighter, more apt members of each class were capable of vastly more intellectual effort than was necessary to keep pace with the teaching. But granting, for the sake of argument, that more time was really needed to properly present some portions of the subjects taught, a month added to the session would have added twelve weeks of teaching time and a three year course of nine months would have given us one hundred and five weeks of actual teaching as compared with the same number of weeks in the four year course of seven month sessions.

Memo. seven-twelfths of 52 equals 30, plus. Minus two weeks of holidays and two weeks for mid-term and final examinations leaves 26 +. Multiplied by 3 (years) equals 78 weeks.

Seven-twelfths of 52 equals 30, plus. Minus four weeks leaves 26 +. Multiplied by 4 (years) equals 104 + weeks.

Nine-twelfths of 52 equals 39. Minus four weeks leaves 35. Multiplied by 3 (years) equals 105 weeks.

Whether more than three years, of seven months each, is needed is a debatable question and one that I do not care to entertain in this paper. For my purpose it is sufficient to show that the actual teaching time of a four year course of seven months each is barely that of a three year course of nine months each and thus dispose of the argument that more time for teaching was a factor worthy of consideration in influencing our action. It has been and will be argued that the Southern schools do not want an eight or nine month's course. The obvious answer to that lies in the fact that some of our dental schools already had nine month sessions and there is no rule prohibiting others from extending their sessions to nine months if they find seven months insufficient.

With the "time for teaching" argument settled, consideration may be given to the only other argument of which I have knowledge, namely that

more time is needed for the perfection of the practical knowledge and manipulative ability of the student. In at least one school, also an earnest advocate of the four year course, none but senior students are allowed in the infirmary. As the school is a large one this course is no doubt made necessary by the limit to the clinical material presenting. But if that is true under the three year course it will be no less true under the four year course, so how will their students be benefited? Or is it anticipated that the four year course will cut down the number of students until the junior and senior classes combined are only equal to the present senior class and thus provide practical work for two classes? Very few schools have clinical material and equipment to accommodate another class as large as the present junior and senior classes, and how is the student to secure more practical instruction under the four year course if the facilities are not to be had? Equipment can be bought and infirmaries might be enlarged, but increasing the clinic one-third is likely to prove a serious problem. It would seem that this feature has already received some attention from college men for the curriculi so far arranged for the four year course, all provide for the student commencing infirmary work not earlier than the latter part of the sophomore year. This would only give some two or three months more time for practical work than is now offered.

Dentistry is a progressive science and no one desirous of attaining and retaining a position in the van ever ceases to be a student. No student perfects his practical knowledge in the college. There is a period in each man's career when he reaches the zenith of his manipulative skill and ability, but it is useless to think of keeping students in college until that time arrives, for it is the result of years of practice only. In considering the time necessary for the education of students in practical operative and prosthetic dentistry, we can only expect them to achieve a degree of skill that will enable them to perform the ordinary duties of a practitioner with credit to themselves and with benefit to their clientele. No college graduates dentists "full panoplied" like Minerva sprang from the brow of Jove. It cannot be done in twice three years. Much of any practitioner's best instruction must come from the good school of personal experience. This has always been and will always be. And if you grant this to be true, the question resolves itself into the amount of time necessary to bring the student to the degree of skill described. In my judgment twenty-four months, being two winters of seven months each, and the ten months of all day intersession practice offered by the best schools, affords ample opportunity for any student that will ever become a good workman, to acquire the skill necessary to perform all ordinary operations in a creditable manner. This has been my experience and this is my belief.

Dental Education Compared with Other Professions.

Let us suppose that in August, 1893, a young man recently graduated from college with the degree of A.B. having three thousand dollars to spend on either professional education or for investment in a business, decides on the former and begins a study of the situation. He finds on consulting catalogues and professional men, the following to be a frank statement of the facts. He can study law in the better schools of the United States for three sessions of from seven to nine months each and be admitted to practice. His degree will not reduce the time necessary for graduation. It will cost him from $50 to $100 per year for tuition and there are practically no other school expenses. In looking over the field he finds the best lawyers in his community prominent members of society. They take high rank in political and civil life. A score of specialties in practice afford opportunities for special fitness to evidence itself, with, perhaps, the judiciary as an ultimate aim. He notes that the best lawyers are liberally remunerated, their fees are large and they accumulate wealth.

Turning to the medical profession he finds his degree will admit him to the sophomore year of a four year course, the college making him this time allowance for knowledge previously acquired. It will therefore be necessary for him to attend only three years of from six to nine months at a tuition expense of from $50 to $100 per year. The other college expenses are merely nominal. When graduated he would have a choice of a dozen different specialties as a life work. Observation teaches him that the best physician in his community are prominent among their fellowmen, that they have large yearly incomes and frequently accumulate some wealth.

And then he investigates dentistry. He first discovers that dental colleges will give him no time credit for work done in other institutions and his liberal arts degree is of no value to him on that score. He will not only be required to enter the freshman class but had he come within one month's time of being graduated from the best medical school in the country, he must still enter the freshman class in a dental school and attend four sessions of not less than seven months each. His tuition will vary from $100 to $150 per year according to the school selected. His bill for instruments will be from $30 to $75 per year more. At the end of four years, if graduated and passed by his State Board, he will be permitted to practice one specialty and only one. The lawyer may elect criminal law, insurance law, real estate law, railroad law or banking law as his specialty; the physician may choose general surgery, abdominal surgery, the eye and ear, the nose and throat, obstetrics, gynœcology, the digestive tract, nervous diseases, or diseases of the genito-urinary tract as his spe-

cialty, but the dental graduate must practice dentistry. Just dentistry.* At best his field is practically "bounded by the lips in front, the pharynx behind and by the cheeks laterally." Our prospective student, in his observation of the community finds that the best dentists are seldom known outside of their clientele and their life work and the practice of their profession does not bring them prominently before the community as does that of the lawyer, and, to a lesser degree, the physician. He finds that the best of them do not attain yearly incomes corresponding to those of the leading lawyers and physicians and that few of them accumulate a competency.

What is the remedy? Either to return to a three year course of seven, eight or nine months, or adopt some laws that will permit students with previously acquired knowledge or more than average ability to complete the course in three years, if they are capable. The dental colleges have made a serious mistake and one that will affect first themselves and next the profession at large. No college man would object to small classes for the next few years if the extra time were needed and better men were presenting themselves for instruction. Better men will only come to us by raising the entrance requirements and offering inducements not offered by schools of law and medicine. This can be done without impairing the quality or quantity of the instruction given. The colleges cheerfully made the various steps in advance advocated by those interested in dental educational affairs because it was readily seen that they were needed and were for the benefit of the profession. Our present rules will work a positive detriment to the profession in turning from our doors the very men we most desire to attract. If this is true, will we have the courage to undo a mischievous piece of work or will we yield to a fear of condemnation on the part of the unthinking and continue a course sure to result in ill? I leave this to you for your consideration.

The College Curriculum.

In looking over the list of studies applicable to a dental training some will immediately suggest themselves as fundamental or foundation studies and their pursuit should be pushed in the early college life of the student. Other subjects, as operative and prosthetic dentistry, are of such vast importance and require so much detail in their presentation that the best results are obtained by teaching them throughout the entire college career of the student. Still other subjects as bacteriology, orthodontia, pathology and oral surgery, requiring a lesser time for their presentation and preliminary knowledge for their proper understanding, naturally come in the middle or latter part of student life. During the past few

*Orthodontia? Prosthodontia?—Ed.

years this association has been favored with several reports and papers on curriculi and many of the outlined courses shown before us on large sheets of paper have been models of typography and monuments to the patience and industry of their makers, but I cannot see that uniformity among the college courses has resulted therefrom. So in this paper I will not make hard and fast rules regarding the amount of time to be spent on each subject but will take up each in turn and give my reasons for believing it ought to precede, accompany or follow other subjects.

Anatomy. Anatomy should receive attention at once. Two-thirds of the total lecture room anatomy taught is most advantageously presented in the first year, leaving the remaining third for the second year. Early in the first year lectures on the various tissues should be given by the teacher having the dissecting room in charge, preliminary to work on the cadaver. In the dissecting room a convenient division of the cadaver is to call the head and neck one part; from the neck to the diaphragm two parts, one on either side of the median line; and from the diaphragm down two parts, again divided by the median line. Before the holidays each first year student should dissect one part, and after the holidays the other part, excluding the head. In the second year the head should be dissected.

Histology. Histology should be begun at once and completed in the first year. The laboratory work should accompany the lectures. Dental histology belongs in the latter portion of the first year. It should accompany or precede lectures on the preparation of cavities. Physiology, pathology and even therapeutics depend largely on general histology for their elaboration, hence this study should be begun and finished as early as possible.

Physiology. Physiology, another fundamental study, should be crowded during the first year. Two-thirds of that to be presented should be completed during that time, the remaining third to be presented in the second year. Pathology and therapeutics both wait on it.

Chemistry. Chemistry also deserves early attention. The completion of elementary considerations and inorganic chemistry, including analytical work, is desirable in the first year, leaving metallurgy and organic chemistry for the second year. The laboratory should, of course, supplement the lecture room. Special chemistry relating to tooth bleaching and other subjects pertaining directly to dental art may be taught in the third year.

Operative Dentistry. Operative dentistry should be begun at once. Lecture room work should consist of the anatomy of the oral cavity and surrounding tissues; general con-

sideration of relations of the parts; the anatomy of the teeth; embryology, general and oral; and the histology of the teeth and closely related parts. This with a few lectures on examination of the mouth, bringing the mouth to a sanitary condition, separation of teeth and the exclusion of moisture, will consume the first year. In the latter part of the year operative technics, supplemented by lectures, may be begun. During the remaining years the course should be progressively developed from the most simple to the most complex problems presenting themselves. The lectures on this subject should be among the last as they should also be among the first delivered to the dental student. How much shall be taught in each year is a matter of opinion, and mine would probably not affect that held by some other teacher.

Prosthodontia. Prosthetic dentistry should also have its beginning during the first year and its ending with the commencement exercises of the student. The arrangement of the course will naturally depend on the judgment of the teacher, but as a general proposition vulcanite work will come first to be followed by cheoplastics, crown and bridge work, interdental splints, et cetera, with porcelain work as the final offering.

So far this curriculum has been easy, and I have felt fairly well assured that the ice beneath me was inches thick, but from now on I realize that air holes and rough spots yawn and yearn to be my undoing.

In a four-year course, materia medica should be taught in the second and therapeutics in the third year. That proposition is easily defensible. Histology and physiology should be completed before therapeutics is taught, as a correct understanding of the latter is based on the former. Materia medica may be taught, however, during the second year, before physiology is completed. It is desirable that the student have the benefit of his therapeutical education before entering on his last year's infirmary work also. In the three-year course these studies are not so easily placed. It is just as desirable to complete them in the junior year here as it is in the four-year course and for the same reason, but we find physiology as yet uncompleted. Considering the advantages and disadvantages of both propositions, I am inclined to believe that therapeutics should be taught in the junior year of a three-year course and materia medica in the freshman year. Both might be taught in the junior year by doubling the time devoted to them, but the junior year of a three-year course is already the hardest of the three and cannot stand much additional burden.

Orthodontia. Orthodontia is best taught in the junior year of both the three and four-year course if time will permit of it in the former. It is desirable, if feasible

that the student complete this study one year before finishing his dental education that he may put his knowledge in practice. However, in the three-year course so much matter of greater practical importance in the training of the student calls for elaboration during the second year that orthodontia may be a part of the last year's course to perhaps a better advantage.

Bacteriology. Bacteriology lectures and laboratory work should come in the junior year of either course. The laboratory work in histology will have given the student the required familiarity with the microscope and a knowledge of the technic of staining and slide preparation. It is desirable that this study shall precede pathology as the latter is based largely on it.

Dental Physics. Dental physics, including strength and stability of filling materials properly comes in the sophomore year of the four-year course and the junior year of the three-year course. This in order that it may accompany the lectures on filling materials.

Comparative Anatomy. Comparative anatomy should receive attention in the sophomore year of the four-year course and the junior year of the three-year course. This is desirable in order that it may accompany or follow the closing lectures on human anatomy.

Oral Surgery. Oral surgery is a senior study in either course. It *must* be preceded by anatomy and physiology and *should* be preceded by therapeutics and bacteriology.

Medical or physical diagnosis, dental jurisprudence, oral and office hygiene, conduct of practice, and similar "finishing" studies should come in the senior year.

Pathology, lecture and laboratory is a senior study. It requires completion of anatomy, physiology, histology and bacteriology for its best elaboration. And that, I believe covers most if not all of the branches taught in our colleges.

Some years ago I had the temerity to hope that uniformity in college curriculi might be accomplished in so far as to regulate the studies taught in each year, not the amount of time devoted to them, but as the years roll on the conviction is forced in upon me that such a hope is but an iridescent dream. However, to fulfil the obvious wishes of the executive committee a list of studies to be given in the three-year and four-year course is herewith appended:

Three Year Course. First or Freshman Year—Physiology, anatomy, histology, chemistry, materia medica, operative dentistry, prosthetic dentistry, chemical laboratory, his-

tological laboratory, operative and prosthetic technics and dissecting.

Second or Junior Year—Physiology, anatomy, comparative anatomy, chemistry, therapeutics, operative dentistry, prosthetic dentistry, bacteriology, dental physics, chemical laboratory, bacteriological laboratory, operative and prosthetic technics, infirmary practice and dissecting.

Third or Senior Year—Operative dentistry, prosthetic dentistry, orthodontia, medical diagnosis, dental history, oral hygiene, dental jurisprudence, oral surgery, pathological laboratory, porcelain technics and infirmary work.

Four Year Course.

First or Freshman Year—Physiology, anatomy, histology, chemistry, operative dentistry, prosthetic dentistry, chemical laboratory, histological laboratory, operative and prosthetic technics and dissecting.

Second or Sophomore Year—Physiology, anatomy, comparative anatomy, chemistry, operative dentistry, prosthetic dentistry, dental physics, materia medica, operative and prosthetic technic, metallurgical laboratory, chemical laboratory, dissecting and infirmary work during the last half.

Third or Junior Year—Operative dentistry, prosthetic dentistry, therapeutics, orthodontia, bacteriology, operative and prosthetic technics, bacteriological laboratory and infirmary work.

Senior or Fourth Year—Operative dentistry, prosthetic dentistry, oral surgery, pathology, medical diagnosis, dental history, oral hygiene, dental jurisprudence, pathological laboratory and infirmary work.

Discussion.

Dr. J. B. Willmott, Toronto, Can.

When I entered upon this work I canvassed this subject from much the same standpoint as Dr. Black. I represent a school that went into the four-year course in good faith. We rearranged the entire course with a view to adapting it to a four-year course so that our freshman course this year differs materially from the previous course in the same year.

When I sat down to prepare this paper, the question arose, "was I to discuss the paper of Dr. Hunt, or the subject, or both?" A little consideration decided for "both." A glance at the programme provided by the executive committee admonished me that my contribution must be brief.

The Dental Curriculum.

The subject, "the dental curriculum," is, to those associated with dental schools, as well as to students, present and prospective, a very important one. It may well be considered under three heads; "the various branches of study to be included," the "time to be given to their mastery as a whole," and "their assignment to the several years of the

course." Dr. Hunt discusses first, the second of these divisions, namely, "the length of the course." So far as this institute is concerned, being made up of representatives from colleges in membership in the National Association of Dental Faculties, this is presumably settled as one of four sessions of seven months each. The essayist seeks to reopen the question and argues strongly against a course extending over more than three years. The argument is summed up in the conclusion, that a young man of fair education, not being a "fool" or an "ass" will not study dentistry under a four session course, the reason assigned being that the emoluments and other advantages offered by law and medicine are much more attractive. I think he is decidedly astray in his presentation of the financial argument. My observation, in my own country, is that no class of professional men, entering upon the active duties of their profession, so soon establish a paying practice, and are in a position to marry and form homes and domestic circles for themselves, as the well equipped graduates in dentistry. I venture the opinion, based also on observation, that excluding, say, five per cent of physicians and surgeons and lawyers, who in their wider field command extraordinary fees, which are seldom open to the dentist, the average income of the dentist will exceed that of either of those named. In these United States there are probably one hundred physicians and as many lawyers, who abandon their profession, failing to secure financial success, where there are ten dentists who pursue a similar course for the same reason. These considerations do not show that the young men who study dentistry are necessarily deficient in their "sanity" or "sense." So long as a fair proportion of dentists are undoubtedly earning good incomes, the pecuniary aspect will not deter suitable men from entering the profession. So far as social position is concerned, every man who is not born to a "social position" must make it, if he ever has it. In making it, in this democratic country, character and culture are much more important factors than his calling, professional or otherwise. The essayist seems to have overlooked another very important factor in the consideration which determine a young man's choice of a calling in life. Men vary greatly in their tastes, ambitions and general mental make up. The type of mental endowment, which would be attracted to pedagogy, law or medicine, would look upon the practice of dentistry as unendurable drudgery. On the other hand, the type that takes intuitively to buying and selling, trading and speculating, would abhor any kind of professional life. The type of man that would be attracted to the profession of dentistry is characterized by the mechanical and constructive instinct associated with the artistic taste. In choosing a calling, such a man would decide between dentistry, engineering, architecture, manufacturing, and similar occupations. These considerations, much more than the length of the course, will be the deter-

mining factors in the choice of a calling. My deliberate judgment is that the raising of the standard by requiring a better preliminary education and by lengthening and widening the course, will bring into the profession a class of students coming from a higher social grade and with decidedly truer professional instincts and ambitions. The numbers will, at first, be lessened; but the quality will be improved. The only danger, if danger there be, will be the possibility, that by the largely increased expense of entering the profession, we may shut out a class of young men, whose ancestors, through many generations, have been engaged in mechanical pursuits, until the constructive instinct and ability have become a positive inheritance. There is no doubt that this class of young men, when possessed of the necessary mental alertness, make the very best and most successful operators.

So far we have considered only those conditions which operate to attract or to hinder young men who are contemplating the study of dentistry. This is not, however, the whole case. What is a reasonable time in which to undertake to make an efficient dentist out of the average student? Dr. Hunt says, that relatively to law and medicine, three sessions are sufficient. Dr. Junkerman says that under any circumstances, three sessions are better than four. Let us inquire into this matter. What is required of the competent dentist? Saying nothing for the present of the scientific knowledge, which is essential to his success, he is required, as an operator, to be able, under very inconvenient, and in many cases very difficult, conditions to make a mechanical operation, which to be useful must be practically perfect, and which requires for its accomplishment as fine and accurate manipulation, and as perfect correlation of the brain, eye and hand, as any work in the whole range of mechanical pursuits. How long a time will be required, on the average, for the student to acquire this manipulative skill? What do we learn by inquiries concerning apprenticeship in mechanical callings, which do not require greater manipulative ability? For example, engraving, lithographing, gem-setting, watchmaking, or of the coarser trades, plumbing, gas-fitting, brass finishing, etc. I understand that three years is considered the shortest time in any of these occupations, in which the tyro may become a "journeyman" and entitled to "union wages." Not three years of seven months each, but thirty-six months of continuous application. The weak point in the American dental curriculum, so far as the development of manipulative skill is concerned, is its intermittent character. A man would be considered far from wise, if he undertook to make an expert engraver by starting a student with eye glass and tool to gradually acquire accuracy of touch and perfect obedience of muscle to will, and then, at the end of seven months, when he was making perceptible progress, take him from his bench, and for five months,

with pick axe and shovel, set him to making roads. At the end of the period bring him back to his bench, with eye glass and tool for another seven months, and for three or even four years go through the same absurd procedure. At the end, what kind of an engraver would he be? This is precisely the way in which the accepted curriculum proposes to develop the manipulative skill of the student of dentistry. It is very doubtful if ten per cent of dental students give any attention to either theoretical or practical dentistry during the interval of college sessions.

Continuity of Study.

Should sessions be longer than seven months? No. If students apply themselves closely to the scientific studies presented and fill up the time with manipulation, the session is long enough to weary, and in many cases to exhaust them. He should, however, keep up his manual training during the entire year, and his attention should not be distracted by other pursuits, if the highest success is to be obtained. But you say the student of law or medicine takes recess of four or five months. True, but their work is purely mental, while that of the dentist is both mental and manual. What of the embryo engineer or architect? His course is continuous, so should be that of the dental student, either in school, office or laboratory. If this intermittent and broken course is to be continued, then I wish to be understood as contending strongly for a four session course of not less than seven months each.

As to what should be included in a dental curriculum, there will not be much difference of opinion, and time does not permit me to discuss it.

As to the assignment of the various subjects of study to the several years, there is likely to be a great variety of opinion, based largely on the varying conditions of different schools in relation to the other faculties in the same institution. In my judgment, our dental curricula are not as logically constructed as they might be. Our purpose is, or ought to be, to educate dentists to successfully treat the pathological conditions of the teeth and surrounding tissues. This requires, in addition to everything else, and may we not say, above everything else, manipulative skill. Skill requires time for its development. We should commence to develop this skill in the first year, and continue it through each successive year. The first year should not be given over wholly, or even principally, to medical and scientific studies. The *work* should be technic, and time filled in with didactic teaching in other subjects. Every subject cannot be taken in the first or even the second year, however desirable it might be. Basic subjects should be taken, first, then those which depend upon them naturally follow. Physics should precede chemistry. Histology should precede physiology. Materia medica and bacteriology should precede therapeutics and pathology. Theory, as a rule, should precede practice. The work should

be divided evenly over the four years. In this connection, I want to say that patients in our infirmaries have some rights. They should not be made the victims of crass ignorance on the part of students. Before being admitted to the infirmary the student should have attended lectures or operative dentistry, prosthetic dentistry, pathology, and therapeutics. This he may do in his second year, and be permitted to work in the infirmary the whole of his third and fourth session, reviewing his didactic teaching in dentistry at the same time.

The writer has been occupying the position of dean for twenty-seven years and has given some consideration to the dental curriculum. As a result of experience, observation and conference, he ventures to submit the following as being complete as to matter, fairly even as to distribution, and reasonably correct as to sequence.

Curriculum for a Four-Year Course.

First Year—Lectures: Histology, bacteriology, comparative dental anatomy, metallurgy, physics, materia medica, operative and prosthetic technic, commence anatomy. Laboratories: Histology, operative and prosthetic technic.

Second Year—Lectures: Therapeutics, orthodontia, crown and bridge work. complete anatomy, commence dental pathology, operative and prosthetic dentistry and chemistry. Laboratories: Practical anatomy, operative and prosthetic technic, crown and bridge work technic, orthodontia technic.

Third Year—Lectures: Electro-therapeutics, complete operative and prosthetic dentistry and dental pathology and chemistry, commence physiology, medicine, surgery and general pathology. Laboratories: Infirmary, operative, prosthetic, orthodontia, crown and bridge work, chemistry, bacteriology, pathology, porcelain technic.

Fourth Year—Lectures: Jurisprudence, physical diagnosis and anesthesia, complete medicine, surgery and physiology, history of dentistry, ethics, hygiene and prophylaxis. Laboratories: Infirmary, operative, prosthetic, orthodontia, crown and bridge work, porcelain work, chemical metallurgy, clinical medicine and surgery at the General Hospital.

Dr. G. V. Black, Chicago.

Dr. Hunt has given us a very frank expression of his views in regard to the four-year course, and also a very good resume of the curriculum for the three-year and four-year courses. Perhaps, I might as well say a word in regard to the curriculum.

The Four-Year Course.

I have not troubled myself much as to the curriculum of the four-year course, believing that until that course is developed further in practice, it is not necessary for us to worry our minds as to how the studies

should be arranged in that course. I have started my freshman class on the same course of studies precisely that I followed in the three-year course, and I expect to continue them in the same way in the second year, allowing the new curriculum to develop itself as the four-year course is developed. There is a very good reason for that, about which I have spoken to you before. Immediately after the four-year course was adopted a resolution was offered that would shut off from return, under the conditions of the three-year course, all those who were out for more than one year, which in due time became a law of the Faculties Association. This will give us students for the first year of the four-year course that we must graduate in three years' time. And for these it is well to keep open the three-year course. It is well to keep in the line of the three-year course for the first three years of the four-year course, and after that we will have plenty of time to give them in the fourth year, such work as they may require. Then, too, we can shape our four-years' course so as to meet the demands.

This was my idea from the beginning and was my idea when I opposed the resolution of shutting off men from the three-year course who shall have been out for more than one year, so that we would not have these men mixed up with the four-year course afterward. I do not expect that the schools of this association will become entirely harmonious at once as to their curricula. It will require considerable time to do that; but I think the development in that line is satisfactory; perhaps, I have more to do with this than any man in the association, for the reason that I have such a large number of students coming to me from other schools. The difficulties in classifying these men are very great, and will be for some time to come. I have had to go over this work of classification for nearly seventy students this year who have come to us from other schools; and in this work I get to see the difficulties existing in the curricula of many schools, as we do not see it in any other piece of work we have to do.

As to the curriculum: I would make some things different. I want two years in histology, even in the three-year course, and in some of the other studies I would arrange the time differently. But we will come together on this in time.

Now as to the desirability of the four-year course, basing it purely on the question of desirability: We will argue it from that standpoint alone, or from the position taken by the Faculties Association, and our indisposition to go back on that which we have done. I know the history of progress in dentistry pretty well. I have been careful to tabulate the progress from the one-year course of four months, followed by graduation, to the two-year course of four and five months, followed by graduation. In the two-year course some schools gave six and seven months, and others gave only five. Then the progress to the three-year course, and now the prog-

ress to the four-year course. We had the same difficulties in passing from the two to the three-year course. I remember that one man at that time told me that he did not know how to dispose of the time. I expressed my regret at that, because I did not know how to do enough work for the students in three years.

At the beginning of the three-year course the freshman class in most schools was very small. Apparently many students hesitated to go in on the three-year course, and many schools were discouraged on account of the small freshman classes, and many would have been glad then to go back to the two-year plan. But it was only a short time before the schools had as many students as they ever had before (not more than three years), and in five years from the time we went from the two-year course to the three-year course the aggregate of graduates in the schools of the country was as high as at any time during the two-year course, and one-third more tuition was being paid into our schools than during the same period of time in the two-year course, which amply repaid the schools for the additional teaching work they are doing.

This is what statistics show as to the progress made, and the same will be true in the change from the three to the four-year course. It will take us a little longer, but not much. The development of the schools is not quite so rapid now, as when we went from the two-year to the three-year course. That was the time of boom in dental school work; that has slacked somewhat at present, and the number of dental students are not increasing as rapidly. But within four years, at least, we may expect that we will have as many students as we had at our last session of three years; barring the extra number of students that rushed in to obtain the three-year course. In a few years after that we will be graduating as many dentists as we are to-day. Therefore, from a financial standpoint we have no reason to fear the four-year course.

Is Dentistry Progressing?

Now, from another standpoint: While the essayist has given you an elaborate description of the student seeking a profession, yet his references to dentistry have been such as I do not like to hear before this association. I do not care to mention these references specifically, but I take an entirely different view of the matter. I have taken some pains to study this problem. I thought it my duty to my university to do so. They have asked me about this; what would be the result; what is dentistry doing; what is its future; why should four years' time be required? And for this reason I have given this matter considerable thought. I have looked about me as to what dentists are doing; whether they are leaving their profession and taking up other pursuits. As to whether lawyers and doctors were doing likewise; and I made some comparisons on that point. The re-

sults are very favorable to dentistry, and I do not believe that the *ears of the dentists are lengthening today,* nor will they in the future. I have gone to the houses dispensing materials to dentists, and I have asked them about their clerical force ten years ago and now. I have asked about their sales ten years ago and now. I inquired not only as to the differences in dollars and cents, but also as to the difference in the quality of material used. One house showed me their books of twelve years ago. I do not believe that this house is getting a greater share of the business proportionately today than they did then; in fact, I believe that they are not getting as great a share of the business now as they did then. Twelve years ago they had twelve men in their employ as clerks, dispensing their goods. Last fall they had sixty-three. As to the quality of the goods used—they told me that a large share of the increasing business had been in the more expensive goods; those used by the better class of dentists.

Furthermore, the traveling salesmen with whom I talked said that in the little towns throughout the country, where, ten years ago, there were no dentists, because they could not make a living, there are dentists today, and these men are buying goods, and they are paying their bills. What does this mean, gentlemen? Simply this: Dentistry is developing more rapidly today, and the use of dentistry, the employment of dentists by the people, is greater now than it ever was before. The people are becoming more critical. They are demanding better dentists; they are requiring more of their dentists; they are looking more carefully and knowingly into the quality of dental work than ever. Therefore, the dental houses find a better class of dental goods in demand. Why is this true? Because we are sending out a better class of dentists now than ever before. They are serving their clientele better, and the people are making greater use of the dentist now than then. That is the reason, too, why these houses are selling more and better dental goods. The demand for the service of the dentist has doubled within less than ten years, and it will double again within the next ten years, if we send out men who are capable and honest in serving them.

Is Dentistry an Attractive Field of Labor?

Gentlemen, these are facts that cannot be gainsaid. Any one of you will find this to be true. The demand among our people is for educated men; better men than we can properly prepare in the three years of time of the material we must take into our dental schools at the present time. The demand is for a higher class of men; men who can and will do honorable work; men who are capable of giving excellent service. I grant that there are men who pass through our schools in a perfunctory way who do not practice afterward; or practice, and then fall out; but the proportion is not so large as in either law or medicine. Today the large majority of men who graduate from our schools go out and prac-

tice dentistry successfully. This cannot be said of either law or medicine, especially the former, because the majority of men who graduate in law do not make successful practitioners. A larger proportion of those who go out to practice medicine fail than is true of the dentists. I grant that some lawyers make more money than some dentists. Dentistry is not a profession in which men pile up money very rapidly, but it is a profession in which a larger proportion of men make a good and honest living than is the case with the graduates in any other profession.

Now, is a man a fool who makes a choice of that which gives him more certainty of a good honest living, rather than to choose that which has in it the prospect of making a fortune, or nothing at all? I think not. A greater proportion of men succeed in earning a good fair living in dentistry than they do in the mercantile business. In fact, I do not know of any business today to which I can point and say that it is safer for the young man than dentistry; that is, a man who comes with educational requirements that seem to be necessary to him to enter dentistry.

The Four-Year Course.

As to lengthening the course: If I had had just my way about it, I would have said, "Let us go to the high school graduation first, and to the four-year course later." I would rather have had our students have those other two years in the secondary schools than the one additional year in the dental school. But I gave way to the majority, understanding its meaning as I understand it now. I am not disappointed in the result thus far. I have no reason for wishing to recall my vote. I am not convinced that I was wrong or that the profession was wrong.

Only one year after we went to the three-year course the proposition to go to the four-year course was made, but few were in favor of it. And every year since, but one, it has been before the Faculties Association, every year receiving more votes, and growing in favor, until the year at which it passed it seemed inevitable, and nearly every one voted for it. Every man had the opportunity to study this matter, and study it carefully, and I feel, gentlemen, that it would be a shame, after having studied it for ten years, then passing it and giving an extra year, before putting it into effect, that we should go back upon our action. It seems to me that the educational world will say that the dental profession should be ashamed to go back upon that vote. My advice is to stand fast to that which we have done. Show to the world that we are in earnest; that we mean what we say; that we are doing this for the better education of dentists. We are doing this so that our men may go out strong men; that when the people employ our graduates they will not be disappointed in the result. Let us put our shoulders to the work with a determination to do it well; to send out young

men as well fitted as it is possible to make them; and then the people will applaud our action.

Advance Standing for Academic Degrees.

Now as to the plea that no recognition is made in dentistry of the man who has a B. S. or A. B. degree. A resolution is now before the Faculties Association allowing the schools to advance men having such a degree, if they do their work sufficiently well, so as to enable them to graduate in three years; and judging from the discussion of it, I have no doubt as to the result. There are many things in our rules that are arbitrary and unjust. They were the best at the time of their passage, but they are not so now; they will be changed gradually. There is also a resolution before the Faculties Association for the recognition of the work done in other than dental schools. There has been an arbitrary injustice in the rule that none but graduates of medical schools should have any credit on time. That was an unjust ruling, and we have the machinery in motion to wipe that out and make more just rules.

As to the rule in regard to medical schools: We have made the rule that none but graduates shall be allowed time, when, as a matter of fact, the studies upon which they are allowed time come in the freshman and sophomore years entirely, and not in the other years. It worked an injustice. We will give these men credit for work done in other schools and will allow them the time required to do this work up to a certain extent, but we must recognize that the purely dental curriculum must require a certain length of time, no matter what advantages the man has had in the way of other education. From two and a half to three years are required for this part of the work, and it must be met, no matter what the education of the man may be.

But we have not had any difficulty with that in the past, and there will be none in the future. It requires time to bring all these matters into shape, and it will be done as the years pass by. As to standing fast—there are some of us who feel discouraged because our freshman classes are very limited this year. But, gentlemen, hold on. If you can do your work well you have no reason to fear.

Dr. E. H. Long, Buffalo, N. Y.

There is one feature in the address and the discussion that appeals to me. I am sometimes consulted by young men as to which they shall take up, medicine or dentistry, and being somewhat conversant with the work in both, I feel that I have been able to direct them along lines of fact, and usually place the matter in about this way:

Dentistry is a growing field, and Dr. Black has very well set forth his belief that during the last ten years the demand for the services of the den-

tist has doubled. I think we need only to add that the field of dentistry is limited only by the degree of education of the people concerning the value of the preservation of their teeth. Contrasted with that, the field of medicine is restricted, and it is becoming more and more restricted, because there are less diseases to treat. You will at once appreciate this when I refer to what would have occurred twenty years ago in case of scarlet fever occurring in a family of ten. At that time all the children in the family would have taken the disease; today only the one child need have the disease, because it is isolated promptly. The statistics of New York show that the death rate from tuberculosis has diminished forty per cent. All this means that many diseases are being prevented and that the field of the physician is being restricted.

In regard to the expense: I tell these young men that it costs more to acquire a medical education than a dental education, which is a fact. The essayist was in error when he stated that the fees in medical colleges range from fifty to a hundred dollars per year. The cost of equipment of a first-class medical college today is so great that the fees must necessarily be higher than those of the dental college. Most of the better class of medical colleges have fees above one hundred dollars, not including laboratory courses and other incidentals. Some medical colleges have fees as high as two hundred dollars a year. And with this the medical student has no opportunity of securing a position as assistant, that will lighten the burden of fees somewhat. I think that the comparison is in favor of dentistry.

Dr. A. G. Friedrichs, New Orleans, La.

It may be temerity on my part to express an opinion on account of the fact that my period of service does not extend over many months. Most of my teaching experience has been gained in the faculty of a post-graduate school of medicine. I accepted the four-year course and am preparing my students on that plan now. I think that it would be a sheer piece of cowardice to acknowledge that we are in a position where we cannot maintain the four-year course. That other professions offer special advantages is not true, and even in medicine, if you wish to engage in one of the specialties a further preparation of at least two or three years is required. No man living who has just graduated from a medical college would attempt to perform an operation on the eye without having had special training in that line of work. Neither would a recent graduate in medicine think of performing a laparotomy, unless he could not do otherwise because of force of circumstances. Such operations are performed only after having had years of experience. He must take further education in these special lines of work.

The fact of the matter is that the profession of dentistry was never arranged properly so as to be taught correctly. The whole plan of instruc-

tion is out of joint, and if I had my way, I would not admit a single man to my school who did not have a medical degree. Then we could make our course one or two years, and teach only the dental specialty. The degree of D. D. S. does not convey all it should; it does not give you the recognition it should. I am an M. D. and I have every privilege that you possess. I have had every honor in dentistry that could be bestowed on a dentist; there is nothing that has not been mine in the way of either dental or medical honors, so that I have no ax to grind. But, we must not acknowledge that the standard has been put too high for us to follow.

Dr. F. C. Platt, San Francisco, Cal.

There seems to be a general impression that if this association recedes from a four-year course it is taking a backward step, of which it should be ashamed. Any man who makes an error and then corrects it has no need to be ashamed of that action. Therefore, if we have made an error in extending our course to four years, and then recede from it, we have nothing to be ashamed of; we simply acknowledge having made a mistake, and do all we can to remedy it.

I have yet to hear a sound argument to prove that the four-year course of seven months is better than a three-year course of nine months. If the colleges which now have a seven-months' course will adopt a three-year course of nine months each they will be giving their students twenty-seven months of work in three years, as compared with twenty-eight months in four years. They will be giving only one month less of tuition. In the four-year course there are fifteen months of idleness, whereas, in the three-year course of nine months there are only six months of idleness, during which time little attention is paid to dentistry. It is a well known fact that if a student has once acquired the habit of study and then breaks it a part of the following term must be spent in reacquiring it. The present course does not tire any student who attends to business while he is in school. Every dentist in active practice works ten or twelve months in the year and often many years elapse before he feels that he can afford to take a vacation.

I believe firmly that there is no retrogression if a three-years course of nine months is adopted. To go back to a three-year course of seven months would be retrogression, but there is a decided advantage in the three-year course of nine months, and I am convinced that we can make as finished a dentist, so far as any school can make him, in that time as in four years of seven months each. The only argument I have heard is that some students must have five months during the year in which to earn enough money to go on with their studies. But that is rank nonsense. If a student leaves the college for five months and does something else during that time he is losing the habit of study which has been instilled into him. If a student must work his way through school, he would better commence his

studies one year later and work a year longer before entering, so he will have enough money to carry him through college without having to return to his previous occupation.

We cannot improve the standing of dentistry by adding to the length of the term unless at the same time we improve the material we have to work upon. If we are going to have dentists what they should be, let us be careful about the material that we take into our colleges. Increase the preliminary requirements; get students who already have their education; get students who have been taught habits of industry and who want vacations only long enough to give a helpful rest.

If we are going to make the four-year course one of nine months in each year, very well; that would be a decided gain, but this is not true of the four-year course of seven months.

Beneath all this lies the question of fees, upon which all our colleges are more or less dependent, but I do not like the undercurrent running through all our meetings, leading to the belief that the fee is the main thing. Until the question of fees is subordinated to the fact that we must turn out a good and finished product, we are not doing our best. Many of our teachers are not receiving good fees; many of them are losing money by teaching, because they are losing valuable time at the office; but they continue to teach because they feel they are aiding the profession, and are doing their duty not only to the profession but to the public as well.

Dr. R. H. Hofheinz, Rochester, N. Y.

If I had my way, I would demand four years of nine months. The question of vacation has been forcibly impressed upon me by the remarks of Drs. Platt, Hunt and Willmott, and, although I came here to advocate strongly the four-year course of seven months, I am now in doubt, after listening to the arguments of these gentlemen, whether that course is the best thing for our schools. We all know what a long vacation in our own practice means. What does it mean to the student who is away from dentistry for five months, and who, during that five months, does not apply himself? Of course, there are many who are obliged to earn sufficient money for their next course. These men will apply themselves, but that class is always in the minority.

The law of supply and demand applies to scientific work, as it does to business. When our three-year course was established we did not have the amount of work to do that we have today. Look at our didactic teaching! Look at our bacteriology. Where was it ten years ago? Take crown and bridge work; take porcelain work; we must have additional time. But I do not at all agree with Dr. Fredrichs, who advises to take medical students and claims that in two years we can make first-class dentists of them. I do not believe that. I remember a number of instances, and particularly a

graduate from a European university. It took that man two years to learn the difference between a square and a round hole.

I plead not only for the additional time, but also for specific preliminary education, and it is for that very reason, as Dr. Hunt correctly stated, that so many of our dental students later on change their vocation. They are unfit to practice their profession, and that unfitness should, to a degree at least, be found out before they enter college, and not afterwards.

Dr. W. F. Litch, Philadelphia, Pa.

When in the National Association of Dental Faculties the proposition to extend the course from three years to four years came up for a final vote, I had instructions from the Pennsylvania College of Dental Surgery to vote for a three-year course of eight months rather than a four-year course of seven months. That was the preference of our school then, and it is the opinion of our faculty now that properly utilized that time will meet present requirements. We fully recognize the necessity for the extension of the course. Dr. Black has told us that the Faculties Association was ten years in developing the four-year course, and yet when the advance is finally consummated, and two years afterward, he is unable to tell us what he is going to do with that fourth year. The Pennsylvania College of Dental Surgery attempted to formulate a four-year course, and finally concluded to do what Dr. Black has done, to continue the present instruction, with the addition of one or two subjects for study, and devote the fourth year mainly to practical operations and prosthetic work.

An extension of the courses to eight or nine months would be advantageous to our school, because our clinics are most largely attended in April, May and June. If we kept our students at work during these months they would have an abundance of clinical material and would be better fitted for their life work. That is the way we look at it from the practical standpoint.

Dr. Black has said very judiciously and justly that dentistry commands the confidence of the people. That there has been an enormous increase in the amount of dental practice. And that there has been an increase in the proficiency of dental service. All that is true; yet all that advance and increase and progress has been the result of the labors of men who had a training of only two or three years. I came here with an open mind, and I am not ready to vote for an entire reversal of the action of the Faculties Association. But I want to know what we are to do with the fourth year. It is not merely the calendar by which we are to judge of progress, but by work that is done in a given time, and I am convinced that we can do all the work really needed in three years of eight or nine months that can be done in four years of seven months. Education was

made for man, and not man for education; and if we can train men properly in three years of eight or nine months, there is no justification for sacrificing one year of their lives in college attendance, which, however advantageous it might be, is at present not absolutely necessary to the making of a good dentist out of a good student, and certainly will not make a good dentist out of a bad student.

Dr. D. M. Gallie, Chicago, Ill. It seems to me that all here agree that an extension of time is necessary, but the question now is whether that extension should be to three years of nine months each, or four years of seven months each. And we all agree that another step in advance would be the increase in preliminary requirements of students coming to our dental colleges.

Some advocate a B. S. or A. B. degree, claiming that the holder of such degree should be allowed some time. I believe that that would cause much trouble, because the average young man who comes with an A. B. degree has the advantage over the young man who is only a graduate of a high school. The high school is the highest government school we have, and a graduate from that school, I think, should be entitled to enter our dental colleges or any other professional school. When you go beyond that, there are schools for those who possess advantages that the average young man does not have. When a man graduates from a high school he should be allowed to enter our colleges and be given all the privileges that are extended to the man with a degre.

Furthermore, I can mention schools, East and West, where a B. S. degree can be obtained in three weeks, and in some places the degree can be obtained for $50, without any attendance at all. But few high schools graduate students unless they are fit. We should exact a high school diploma of our matriculants, and I believe in time we will come to it; when we do we will have material that we can teach as much as is necessary in three years of nine months.

In my limited experience in the infirmary I have found that the student who is fortunate enough to be able to stay through the summer and work in the infirmary is far ahead of his less fortunate classmates. From what I have seen I am led to believe that if the colleges adopt the three years of nine months many students will be in such position that they will be able to go the first year of nine months; then take a vacation of three months. And for the next two years they will continue through the whole course of twelve months, putting in their time during the regular college course and working in the infirmary for three months. If they will do that, they will be far better dentists at the end of the three years than the student who attends seven months for four years, with a vacation of five months each year.

As Dr. Willmott and Dr. Platt have said, a young man out five months loses his cunning and the habits of study so that he comes back to school handicapped. I believe that the course is all upside down. The young man coming from the workshop is not on the same plane with the student who is a high school graduate. His mind is not in the same receptive state with regard to the scientific studies. You cannot teach him bacteriology, physiology, histology, etc., with the same degree of understanding. We should start such men in on lines which they can understand. Teach them finger craft. Schools should have all the material and equipment necessary to develop handicraft, and then during three years of nine months you will have plenty of time for the teaching of anatomy, physiology, bacteriology, etc.

Dr. F. B. Noyes, Chicago, Ill.

The highest school is the highest public school, but the State university also is a State institution. Dr. Gallie pleaded first that the graduate of the high school was prepared to continue scientific study, and then he continued to argue in favor of a man having manual training first. A few things occur to me just now that are in favor of the four-year course. One of the greatest difficulties in the dental curriculum so far has been the number of subjects which a student is required to carry at one time. Increasing the length of the three years does not help us out in that respect, whereas the four-year course would. Every teacher knows that it is not desirable for students to carry too many studies at one time, especially when we must teach finger training through the entire course. We must distribute the other work evenly, and that could be done to good advantage in a four-year course, but not in a three-year course. I would be in favor of increasing the number of months per term in the four-year course, but climatic conditions in certain parts of this country would render that impossible.

What is it that has created the demand for the four-year course? It is the increase in the number of subjects with which a man must be familiar, and also a development in the old subjects. For instance, a number of years ago, one course in histology was enough. Today we cannot get along with less than two courses; one a general course, and the other a course applied to dentistry alone, and which cannot be taken until the general work has been completed. In physics we should have a preparatory course and then a special course of applied physics for dentists. The development of porcelain work, of applied electricity in dentistry, of oral surgery, and other special subjects applied to dentistry has made the demand for the increased time, and I would be willing at any time to stand in the face of any one who says they did not know what to do with that fourth

year. The question is what to leave out of the fourth year, because we cannot provide the means of teaching it.

It is not the recognition of the B. S. or A. B. degree that is called for, but a recognition of the work that the degree represents. A degree that does not cover the work of the dental school should not and would not receive any credit. For instance, in my own department of histology, I cannot require a man who comes to us from Johns Hopkins University with a credit in histology to take the work over again under me. But a man coming from some schools of this country may have the same degree as the Johns Hopkins man, but he may not have had the same amount of work, and he would have to take the work in our school again. So that it is only a recognition of the work which the degree represents that is called for.

Dr. S. H. Guilford, Philadelphia, Pa. All of us present are teachers, and we are all actuated by one desire, which is to improve the quality of the product which we turn out from our colleges. We all agree on one thing, that the dental course as now constituted is not long enough to answer our purpose. So that it resolves itself into a question of whether we shall have a four-year course of seven months, or a three-year course of nine months. That question will, I think, have to be decided by certain things, the principal of which is this: Can we do more for the student in three courses of nine months than we can in four years of seven months? If we can do more in four years, then it is the course to adopt; if in three years, then by all means let us adopt that.

I have been a teacher for twenty-two years, have taken a great interest in everything connected with dental school work, and I have found certain conditions which, I believe, all of you find. Whenever we open our school for a new course of lectures, the students have been more or less unsettled by their vacations, and it takes nearly a month before we can get them down to good solid work. They attend the lectures and perform their tasks, but they do not enter into the real spirit of their work. After the students once get settled it is much easier for them to do the work of the last five or six or seven months than the work of the first two months. For that reason it seems to me that if we could lengthen our course to nine months, and have three years of it, it would be an advantage to the student; much more so than to have four years of seven months each.

If we give a student five months of vacation, he falls out of the line of study and manipulation entirely. The laws of the State or the ruling of the State Boards of Examiners will not permit them to do certain kinds of work during their tutelage, hence, much of the work done at college is lost sight of. If they could practice, the loss would not be so great. There-

fore, I believe by carrying them along for nine months the students would be the gainers.

There is another feature, and that is the getting of good demonstrators. We can get better demonstrators if we contract with them for nine months than for six or seven months. Some men would like to make it a life business, but they do not like to be connected with a school for six months and practice six months; nor can they afford to be idle for five or six months. Therefore, I believe, taking all things together, that our students will be able to do better work, and we do ourselves more credit by having a three-years' course of nine months than one of four years of seven months.

Dr. H. B. Tileston, Louisville, Ky. It seems to me that the paper as well as the discussion has digressed somewhat from the subject announced in our program. It seems to be recognized fully that we have no spare time for teaching dentistry in three years of seven months each. We have from time to time added subjects to our curriculum, loading it down, until now we are teaching almost everything in the course of dentistry. Why not take students without any limited time at all, and then apply Dr. Hunt's count system? Take in any kind of material and keep it until it is finished, and when finished, turn it out, no matter how long it takes.

Dr. G. S. Shattuck, Detroit, Mich. Three years ago we adopted the four-year course of nine months and we found no difficulty whatever in filling the time. In fact, if we had more time we could use it to good advantage. We went from fifty students down to eight, but we have come up again gradually to twenty-seven. I, for my part, want to stand by the four-year course.

Dr. F. C. Platt, San Francisco, Cal. I want to call attention to something said by Dr. Noyes on the number of subjects the student is required to take at one time. Why should he take more studies at one time in a three-year course of nine months than in a four-year course of seven months, when he has the same number of hours in which to study?

Dr. G. V. Black, Chicago, Ill. I want to remind you that we have a good many schools in the United States in which a three-year course of nine months is impossible, and the gentlemen directing these schools feel so, especially the Southern schools. If we return to the three-year course, it is almost inevitable that we return to the three-year course of seven months, a backward step that we do not wish to take. Therefore, I think that we should put away this idea that all schools can come to the three-year course of nine months.

Another thing: I do not believe that all students abandon work during their vacation. A large percentage of our students stay in the infirmary, so that they really have a nine or ten months course. But aside from this, we need the additional year for the extra work that is demanded of us; the additional preparedness that is demanded of our dental students that we cannot give them in three years' time.

Dr. J. B. Willmott, Toronto, Can. All the good medical schools have four years, of from seven to nine months, and we are belittling dentistry by cutting our course down to three years. We are publishing to the world that it is a profession inferior to medicine. This we ought not to do.

As to the nine-months course: We live in a very stimulating climate, and yet we find that even at the end of a seven-months course students who have applied themselves very seriously to their work begin to lag, and it is not uncommon for them to break down in the examinations. If they were to continue at the same gait, with the same application, it would be absolutely impossible for them to keep up for another two months, especially in a warmer climate.

A short time ago, in conversation with one of the professors in the University of Toronto, I asked him his opinion with regard to the nine-months course as compared with a shorter course. He said that after many years of experience he had come to the conclusion that men learn more in seven months than in nine, because they cannot keep up the pace so long. I believe that to be true.

Dr. W. S. Bebb, Los Angeles, Cal. Our school is most heartily in favor of the nine-months course and high school graduation for admission to the dental college. If we in Los Angeles can stand the heat, I do not see why the other Southern schools cannot do likewise. I have never noticed the disposition on the part of the students to lag at the end of the course, as was mentioned by Dr. Willmott.

Dr. S. H. Guilford, Philadelphia, Pa. I cannot agree with Dr. Willmott. I think he makes an unjust comparison between medicine and dentistry. He thinks we would be belittling dentistry to go back to the three-year course of nine months, after having adopted a four-year course. His idea is that we should take a stand alongside of medicine; that we should claim it; demand it, and hold it. The fact remains that medicine stands higher than dentistry, and anyone who studies medicine covers a larger field, immensely so, than ours. It includes a wider range of studies, and covers them at greater length, therefore the student of medicine studies more

hours and harder in four years than the dental student, so that they cannot be compared at all.

In regard to the argument that in some parts of the country it would not be feasible to have a nine months' course, let me call your attention to one fact. A few years ago the Faculties Association decided to adopt a seven months' course, and met with this objection, principally made by Dr. Brown, of Milwaukee, who said that the Milwaukee Medical College had a six months' course and that the dental department could not extend the course to seven months. The same objection was made by some other school. Dr. Brown asked permission to have a four-year course of six months, instead of three years of seven months. That would be a solution of this problem, to allow the schools that preferred a three-year course of nine months to have it; and to allow those that preferred four years of seven months to have that course.

Dr. E. P. Bethel, Columbus, O.

It seems to me that the estimating of the course by years and months is not exact. It is more or less misleading. The Faculties Association has adopted a four-year course of seven months. Taking a school that begins its course, for instance, on October 6 and ends it on May 5, a full seven months, you will find that there are 135 teaching days, estimating five days per week, which the majority of schools are teaching. In four years there are 540 teaching days. That is the standard accepted by the National Association of Faculties and Examiners. Now, in speaking of schools that wish to adopt a three-year course of nine months and those that wish to adopt a four-year course of seven months, let us make a comparison, and see what we will find.

Take, for example, the University of Michigan, a college looked upon as a leader in dental education, is a nine months' school. According to their announcement they have three days' vacation during Thanksgiving week; two weeks vacation during the Christmas holidays, and ten days in the spring vacation, giving them a total of 168 actual teaching days in the nine months. Now, let the seven months' school teach six days per week instead of five, and during a full seven months' session they will have 169 teaching days, or one more than the University of Michigan has in its nine months' term.

At the Ohio Medical University our present term is thirty-two weeks, We believe in keeping our students busy, so we teach Saturday as well as other week days, and by doing that we get in 181 teaching days during the school year, or thirteen more teaching days than the University of Michigan. In four years we have fifty-two days, or ten and a half weeks, more actual teaching days in our course than Michigan, although our school is looked upon as a short-term school. Take this same school and length of

session, as stated, teaching only three years, and we find that they would have 543 teaching days, or three more than is required by the Faculties Association, and what is accepted at the present time as the standard of a full course in dentistry.

If, then, in three years, schools of this length term have accomplished all that the Faculties Association requires of any school, why should they not be permitted to grant a diploma at the end of that time?

I believe, to be exact and just, that our dental course should be estimated by teaching days, and not by years and months, which is so misleading. Let us adopt a minimum number of teaching days in each year, and in that way place the work on an exact basis, so that all schools will have the same length of total course. If we adopted 540 teaching days as our standard we would not be taking a backward step, for that is all that is now required. There would not be any retrogression, and yet it would be possible to graduate students at the end of three years instead of at the end of four.

Dr. Hunt.

Dr. Black says he lost my paper. I am sorry, because his discussion did not get within forty rods of the paper at any time. He says that he has not given any serious thought to the four-year course, and that he expects it to work itself out in a few years. If he had given this matter the attention that Dr. Willmott did or that I did, he might have arrived at some definite conclusions by this time. I took up the four-year curriculum, with the desire to put it into execution, and not in the hope that it would finally work itself out, after a fashion. And it was this desire to put it into execution that led me to the conclusion at which I arrived. Dr. Black rather begged the question when he talked about students coming in in time. I tried to make it understood that I was not arguing the question from the standpoint of the number of students that would present themselves, but from the basis of whether this additional time was really needed. I regretted that he took up the financial end of the question, because I eliminated that purposely from my paper.

The question is, is there a limit to the amount of time needed. If we need four years, do we need five, or ten years, or twenty years? There must be some time that is ample for the teaching of dentistry. I argue that if the subject is presented properly three years is enough. Dr. Black does not argue that point at all. He says that we have gone to four years, so do not let us go back. If three years is enough, why stick to four? If we can arrange the three years to give the same amount of work as in four years, why make the student remain in school the extra year? Those are facts, and not sentiment.

I purposely talked pretty roughly about the rewards in dentistry. It

was neglected by the other speakers, much to my disappointment. When an ambitious boy leaves school he believes that by the time he is thirty-five years old he will have the world by the tail and that he will be looking for a place to throw it. The young man just out of school is not looking for an occupation that will give him a "modest living;" he is looking for an opportunity to achieve great things. He wants to be rich and renowned.

But take the ordinary bright young man with ample opportunities in the way of preliminary education, and let him look over the field. Does he find any men in the dental profession who are known, like Senn, Jacobi, Lister, Hare, and others in the medical profession? Or like Choate, Elihu Root, Chief Justice Harlan, and other noted lawyers? Where are our dentists that come before the eyes of the world like the men in these two professions? We do not have them. Most of us keep out of the poor house, and some pay rent instead of moving every month, but none of us get the rewards that are given to the foremost men in medicine and in law. I was not talking about the general run of practitioners, but about the leading men. Take the ten best dentists in Chicago and compare them with the ten best physicians and lawyers, and they are not in it for prominence. It is not a matter of brains or learning, but the profession does not bring them before the community in a prominent way, and the young man who is about to enter upon his studies in some profession, if he looks at the matter in a calm and dispassionate way and is not influenced, cannot help but note the fact that the profession of dentistry does not offer to the very best men in it the rewards the other professions offer to their best men.

That is the point I wanted to bring out in the paper. There is no man to whom I will yield in loyalty to the dental profession, but I see no necessity for trying to throw sand in each other's eyes.

Dr. Black also said that we need the extra year because we cannot turn out the men we should in three years' time from the material presented. That is a part of my argument. You cannot turn out good men from the material presented. But how can you improve the material presented by adding another year to the course? Get better men in the freshman class and you will not need that other year. The fact that there are some resolutions pending to relieve some of the evils that exist does not enter into the argument. I treated of conditions that exist now, and not of those that might exist some time in the future.

Dr. Willmott said that dental students are physically unable to take a nine months' course. Are dental students less able physically to take a course in education than are the students of liberal arts colleges? I took three years of nine months in a liberal arts college, and I am pretty husky yet. I believe dental students are capable of attending school nine months

and doing harder work than they do now. Dental students are not worked hard.

Dr. Friedrichs says that the specialist in medicine must have further preparation. Of course he must. If, after graduating in medicine, a man wishes to practice rhinology or laryngology or any other specialty, he should have further preparation. But here is the point. While it takes just as long to get the D. D. S. degree as it does the M. D., the latter may choose between several specialties, while the former has but the one. After a few years in general practice the young M. D. may find his talents leading him toward a certain specialty as being the one he is best fitted to practice, and a little special preparation fits him to practice it. But if the young man in dentistry is not fitted for success in that one specialty, his diploma is worthless to him. Medicine offers a diversified field, in which a man may look for his life work; dentistry confines his choice to the one specialty. And yet it takes the same length of time, according to our rules, to secure a diploma in each profession.

I am not arguing for retrogression. I do not like to go backwards, but I do believe that there was not an argument presented here today that can be discussed outside of sentimental grounds. I do not believe in trimming our sails according to what the world at large will think of us. If a thing is right, it is right; and if it is wrong, it is wrong. I like what Dr. Platt said. I would rather hear a man argue a point than to resort to sentiment. This is a matter of importance that should be settled on a proper common sense basis, and not on sentimental grounds.

How Shall Quizzes Be Conducted?

By Faneuil D. Weisse, M.D.

The quiz is a most important factor in the imparting of a professional education, therefore its conduct deserves careful attention to obtain the greatest advantage from it.

Passing questions promiscuously from student to student is of little personal value to the student, and of no permanent value to the professor —especially when the fact of prompting is considered. Stated written

examinations during the session—mid-term or more frequent—have not the zest and value of the frequently and carefully conducted quiz before the class.

No fixed dates should be scheduled for the quiz; thirty to sixty minutes per week should be devoted to it in each department.

That the quiz should be impressed with its importance the professor should conduct it; not delegate it to his assistant nor to a quiz master.

The objects to be attained from the quiz are:

(1) That the student may give evidence of, and personally realize the progress he is making in acquiring his knowledge;

(2) That the listening class may profit by the questions and answers —taking notes of the same;

(3) That the professor may realize what progress he is making in imparting his subject to his auditors;

(4) That the professor may judge of the individuality of each student as well as of his accumulating knowledge;

(5) The obtaining of a permanent record of the answers of each student so as to be able to economize the work of the progress (written), or final examinations (written or oral) of the session.

The conduct of the quiz presents two standpoints: the examiner and the students to be examined.

(I.) *Conduct of the examiner.*

The first essential is that the examining professor be prepared to give out his questions rapidly—there should be no halt in asking the questions. To accomplish this the examiner should have a written sequential list of subject headings before him to frame his questions by.

(Indeed, a professor's work is not fully systematized until he has drafted a sequential synopsis of the subject heads of his course of lectures —such a synopsis becomes the compass for all his work of lecturing, quizzing and the end of session examinations.)

The second essential is that the examining professor be provided with a list of the class—by which a permanent record of the quizzes is obtained —on a broad sheet, the line of the student's name to bear the record of the dates of his examining and the tallies of his answers at each examination. (Such tally record of the answers at quizzes by the respective students should be given due weight at the progress and the final examinations at the close of the session.)

(II.) *Conduct of the students to be examined.*

Call out ten students indiscriminately and without previous notice; seat them before you with their backs to and apart from the class—to avoid prompting. Read out the name of one of the ten, who, rising in his place, is asked question after question until he fails, when he sits down;

and so one after another is read out, questioned and seated. When the ten have been finished with they return to their seats in the lecture room, and ten more are called out and similarly dealt with.

As each correct answer is given the professor having entered the date of the quiz on the student's line of the tally sheet, it is tallied after the date. As the ten students return to the lecure room seats the number of correct answers of each is given to the class.

An incidental and most valuable method of quizzing to impress important points, which meets with much enthusiasm on the part of the class, is to unexpectedly—upon entering the lecture room or during or before closing the lecture—call for *viva voce* answers to questions, repeating and revising them from day to day until the examiner realizes that the entire class knows them.

The quizzes, by sections of ten as above detailed, call forth the fixed attention of the entire class and the taking of notes.

As the correct answers of each student are given out to the class—many making excellent records—the genuine enthusiasm evinced by facial expression and applause of the class at a good record reminds one of the enthusiasm shown at athletic games.

How Shall Quizzes Be Conducted?

By L. P. Bethel, D.D.S., M. D., Columbus, O.

Any one can ask questions, but not every one is a successful quizmaster. To better understand what methods of quizzing are most effective, we should first consider the object of the quiz in class work. The object, as I understand it is:

First—To test the student's knowledge of the subject covered by the teacher.

Second—To make the student review thoroughly the lesson recited or the notes he has taken on a lecture.

Third—That the student may gain additional information regarding any portion of the subject he may have missed, or that he did not fully comprehend when it was presented.

A single examination at the end of a semester or at the completion of a session is not, in the opinion of the writer, a thorough test of a student's knowledge of the subject under consideration.

Why? Because the student may be able to answer correctly all, or nearly all, the questions asked in examination and yet be deficient in many portions of the branch not touched upon in that examination. Or, he may be unable to answer satisfactorily the majority of questions asked and yet have a better knowledge of the branch in general than some others who may be able to answer creditably these particular questions. But by quizzing students the teacher soon ascertains who is applying himself and who is not. I believe a daily record of the quiz, or recitation, is of more value as an indication of the student knowledge in any particular branch than any written examination.

It is important then to ascertain how the quiz should be conducted to be most effective. But what is implied by the term "most effective?" In answer to this we might suggest the following propositions:

First—To go over thoroughly the subject under consideration.

Second—To bring out any points the student may have missed or those not fully understood nor comprehended when the subject was presented.

Third—To give a fair hearing to the student being quizzed.

Fourth—To hold the attention of all the students during the quiz hour.

Fifth—To make the student keep reviewing the subjects gone over.

Let us see how this may be accomplished:

First—"*To go over thoroughly the subject under consideration.*" A teacher may be conversant with his subject and yet omit important points by quizzing in a miscellaneous manner. The questions should cover thoroughly the subject matter as presented. I believe in preparing for the quiz the same as preparing for a lecture or recitation; and in preparing I have made it a custom to formulate questions covering progressively and thoroughly the subject matter, and requiring the students to write down all questions asked in the quiz. This is for two purposes: One, that no portion of the subject may be overlooked, and the other, to give the student a working formula from which to study in reviewing. The questions following the text as they do, in a progressive order, enables him to find quickly in his text-book the subject matter referred to by the question asked.

This brings us to the consideration of the second proposition, viz.: "*To bring out any points the student may have missed, or those not fully understood nor comprehended when the subject was presented.*" If the student does not obtain all these points from the answers during quiz, his having written out the questions, and the questions covering the subject thoroughly, give him a means of ascertaining and studving any portions of the subject about which he may feel uncertain.

Proposition third: *"To give a fair hearing to the student being quizzed."* A recitation, or quiz, is probably as trying for the student as any requirement he undergoes, and he should not be called up in such a manner as will embarrass him unless it be as a reprimand. He should be given every opportunity possible to show just what he does know or does not know about the subject, and no restrictions should be allowed.

Fourth proposition: *"To hold the attention of all the students during the quiz hour."* This is difficult to accomplish at all times, and to accomplish it often taxes the teacher's ingenuity. I have made it a custom to never quiz a class in any regular order, but to skip here and there, even recalling some one who has already been quizzed in the same hour if it seems advisable in order to hold closer attention. One must keep the members of a class in a state of expectancy, and my custom has been to ask the question first, then call upon some one to answer. By doing this every one is formulating an answer expecting to be called. If I notice inattention on the part of any particular student, I aim to call upon him. Some times in the midst of a recitation by some one else I will say: "Mr. Blank, you explain this, or explain the rest of this subject to the class." If he has been so inattentive that he did not hear what was recited or lost the connection and asks me to state the question again, I simply mark him zero for inattention and call upon some one else. The next time he is found giving due attention, for he realizes that the quiz markings count for considerable in the final reckoning.

Fifth proposition: *"To keep the student reviewing the subjects gone over."* The members of my class do not know when they assemble for quiz whether that quiz will be entirely on the last recitation, or lecture, or on some of the work already taken. I may ask them questions from several different subjects gone over before beginning on the topic in hand. Or, instead of a quiz, I may require a written recitation at any time. The written recitation appeals to me as a good drill, and although it entails more work on the part of the teacher I believe it pays to give such tests every few weeks. The students who are becoming indifferent to study I aim to quiz all the harder, and it usually whips them into line. At the end of the quiz, I allow enough time for any questions the students may desire to ask, or to explain to them any points not clearly understood.

While this particular method has proven successful in my hands, I do not believe any one method to be equally effective for all teachers. Each teacher must work out his own. That method by which he can best attain the desired results—for the results are what we want, no matter how it may differ from others—is the method for him to follow.

How Shall Quizzes Be Conducted?

By Robt. H. Nones, D.D.S., Philadelphia, Pa.

How shall quizzes be conducted? This is indeed a more important subject to the student body and colleges than is generally accredited to it. Is it not at the quiz that the student seeks for a clearer explanation of subjects? The righting of misunderstandings and misinterpretated meanings? Therefore, I say, it is indeed essential that much thought should be given to the selecting of quiz-masters, number of quizzes per week, hours for quizzing, system of quizzing, etc.

Let us first turn our attention to the system of quizzing from a financial standpoint. Should the schools furnish a free system of quizzing? Should they be regularly listed as fees? Should they be conducted as private or special instructions? Should they be a part of the college curriculum, or should the quizzing depend upon the professor of the chair, devoting a few moments of each lecture hour to quizzing? The answers to these many queries could readily be "Yes" or "No."

The school which furnishes a free quizzing system no doubt offers a greater inducement to the prospective student, but it is a doubtful question whether he receives and gives the general prompt attention as when he has invested a few dollars for private quizzing, unless the institution has a financial standing which would warrant its properly compensating the quiz-masters for the value of their services and time demanded. Institutions so constituted are much in the minority rather than the majority. Then again the receiving of something for nothing is but little appreciated by the human race (the student body being no exception to this failing), therefore the student does not feel in duty bound to attend regularly and promptly; hence much of the quiz-master's efforts are lost. A free quizzing system, at least to some extent, is a necessity, and this I think should be conducted by each professor and lecturer, supplementing the regular quizzes by a few moments of his lecture hour to quizzing on the subject matter previously gone over. This is essential, not alone for the student, but it should also enlighten the incumbents of the different Chairs as to the clear elucidation of their teachings; whether their individual methods are fruitful to the greater number, or but to a few; whether the answers brought out should demand a reconstruction or modification of lectures. It is this personal quizzing by the lecturer which calls his attention to such matters not understood and warranting a repe-

tition of the subject. It is that part, therefore, of a course, which is of priceless value to both teacher and student as it is in many instances the last opportunity given to right wrongs.

Personally I believe that private quizzes, preferably conducted by assistants of the individual chairs or by regular appointees of the Faculty, would be productive of the most good, for the reason that the student would not absent himself and he undoubtedly would give better attention to that for which he pays. The quiz-master having the individual responsibility placed upon him would look to his laurels and the remuneration which should naturally increase with better work would be an incentive to do his utmost.

If the quiz-masters receive a liberal compensation for their efforts the institution could then make a selection from more applicants. Too much stress cannot be laid upon the personnel of the quiz-masters; not enough attention nor sufficient recognition is given them. Their selection should be made carefully with a view of strengthening, not only the individual Chair but the institution as well. The light of the quiz-master should not be prevented from shining, for fear of eclipsing the merit of the senior teacher, the Professor of the Chair. To accomplish the most good and best results one must frequently sacrifice one's feelings longest as the title does not necessarily make the most efficient teacher.

After the selection of a competent quiz-master has been made, his duty should be clearly mapped out for him by the Professor of the Chair, and one of the most important, I believe, is to have him attend each lecture on the subject on which he is to quiz. It is impossible for him to keep in close touch with every thought of the teacher in any other way. Reviewing the lecture notes will not suffice, and by his attending the lectures the students are fully aware that he is well posted, at least on the idiosyncrasies of the professor. It is imperative that the quiz-master be thoroughly qualified; he should command the attention of the student body; frivolity at no time should be allowed to enter into the quiz hour, nor careless nor partial answers be accepted.

The different subjects naturally demand different methods of conducting a quiz, but modifications should not prevent the carrying out of salient points equally valuable to all branches, for example: The individual mind should be constantly kept upon the subject and not allowed to be lax before or after he has answered the question put to him. One way of so doing is that of putting the questions in a regular and systematic manner; questions should not be allowed to pass unanswered too long, for fear of the students losing interest; concise and thorough answers only should be accepted, and all answers and questions should be audibly and plainly given to the entire class, as well as a clear and proper explanation,

particularly of the incorrect ones. The quiz hour may easily be made a medium for ridiculing those holding incorrect views. This should never be tolerated, as it will be followed by lack of respect as well as embarrassment of the student thus made a mark of. Correct or incorrect marks should be entered against each student, not only as a matter of reference but also as an incentive for him to carefully consider questions before answering. Haphazard methods should absolutely have no place in the quiz room; as previously stated, it is here the last chance for correction of misunderstood theories and methods is met. For this reason alone it should be conducted with the utmost care, I would say even more so than the lectures, for upon whom does more responsibility rest, from whom is more individual teaching expected, or with whom does the student body come in closer contact than the quiz-masters and demonstrators? practically they are the teachers and makers of dentists.

Questions which can be answered negatively or affirmatively should be avoided as much as possible, as it is rare that such answers draw from the student any knowledge of the subject. Questions requiring answers with some degree of explanation give the student an opportunity to explain his thoughts and at the same time do much to prevent guessing on the subject. When a student is asked a question he should arise and answer in an audible tone so that the entire class may hear the answer. This also gives the student training in addressing a gathering as well as preventing laxity and carelessness in answers. This individual training amounts to more for a student than might be supposed; it is oft times not the lack of knowledge, but the result of self-consciousness that prevents a student doing justice to himself or the subject with which he may be thoroughly cognizant.

It might be advisable at times to allow students to take turns in conducting the quiz; this would not only be excellent training, but it would probably bring out questions on a line of thought which would not occur to the professor or quiz-master.

Interest can be obtained and retained by the free use of blackboards, diagrams, models, etc., which the student as well as the quiz-masters should use, and thus frequently be able to make themselves clear, when without the use of the same, answers and explanations may be very vague. It is absolutely requisite that the quiz-master be in thorough accord with the lecturer, as nothing will cause greater lack of discipline, be more destructive of confidence than the differences of opinions or methods between the professor and the quiz-master. This absolute understanding of the teachers is not liable if the quiz-master makes no pretense of attending the lectures on the subject, so I think it may be plainly understood

why it is so important for the quiz-master to attend each lecture on the subject on which he is to quiz.

Every subject should be given a regular specified hour each week for a quiz and the time should be selected with a view of deriving the greatest benefit therefrom. I am fearful that it is not infrequent that the quiz hour is crowded into any spare time available, much to the detriment of the subjects reviewed.

The quiz hour should undoubtedly be recognized as part of the regular curriculum and attendance at the same should be required of the students just as much as at the lectures. It is a conceded fact that as a general rule the students acquire more knowledge at one good quiz hour than from many lectures.

Discussion.

Dr. F. H. Berry, Milwaukee, Wis.

I am in sympathy with the papers read and can add but little to the subject. I am teaching prosthetic dentistry, and, as you know, it is almost impossible to get good quiz masters, men of the same opinion as ourselves. I have a way of killing three birds with one stone. We all know what a difficult matter it is to call the roll, because students will answer for each other, and when you quiz they consider it a hardship, and they will say that you are partial. I have a quiz for ten of fifteen minutes before each lecture without having previously announced the subject of the quiz. I call on the first man on the roll and ask him to propose a question. I mark him on the merits of his question. Then I ask the last man, for instance, to answer the question. In this way I make the students do all the thinking. In order that you will not pass a question to the chum of the man who asked it, it is well to dilate on the question yourself or to change it somewhat. I do not confine myself to beginning at any particular place on the roll, but am liable to ask any man at any time without any regard to the sequence of the names. I find that this is a very good way of quizzing, because they are propounding their own questions and the answers show where they are deficient; and then you can enlarge on that particular phase of the subject.

Dr. J. B. Willmott, Toronto, Can.

I would like to get a little information from the gentlemen who have had some experience with large classes. How, with a class of about 150, do they manage to make the men speak up so that they can be heard? Often I cannot hear the answer, and I am sure that many in the class fail to hear it, and these men will, therefore, lose all interest in the quiz.

Dr. D. S. Hoff, Ann Arbor, Mich. Quizzes form a most important part of instruction. Some of the best schools in the country have done away with didactic work altogether. They assign lessons in the text-book and quiz on them. I have very little sympathy with the idea of employing quiz masters, except in the scientific subjects where good quiz masters are available. Every teacher should do his own quizzing, because if he turns his work over to an assistant he is likely to get poor results. Unless the teacher can bring himself into contact with his students he is not doing good teaching, because he does not get any conception of his students' grasp of the subject.

The difficulties with large classes, mentioned by Dr. Willmott, is one that appeals strongly to me. Sometimes I am unable to quiz more than three or four men in the course of an hour. I do not place any value at all on a parrot-like answer taken from a text-book or from my lecture. Nor do I feel flattered by that kind of an answer. I want the answer to show that the student has been thinking about the subject, showing that he has a mind of his own and that he can use it, if need be. Otherwise the entire system of quizzing is of little or no value. The mere memorizing of a lecture or lesson does not increase the student's understanding of a subject. Students should be encouraged to answer in their terms of speech, voice their own thoughts, even though they be incorrect. This will stimulate them to think while subjected to the embarrassment of their surroundings.

Last year I mentioned my method of quizzing, which I found very successful. I have a blank book made of very thin paper and between the pages is a sheet of carbon paper. I put two questions on the blackboard. Some of the men are asked to answer question number one, and others are asked to answer question number two. They are expected to answer these questions in their own words, and I so formulate the question that they cannot quote from any text-book or lecture. Then, after having answered the questions, they give me the original from their books, retaining the duplicate. I pick out those that are answered carelessly and badly, and as soon as all the sheets are in, I read the question and the answer, but without giving the names of the students, and solicit correct answers from the class. If I do not get a satisfactory answer, I give it myself. I find this method to be a very good one, as it quizzes every student in the class, and gives me a chance to restate a point that may not have been made clear in the lecture.

Dr. F. L. Platt, San Francisco, Cal. I have established the rule that when a student does not answer so that he can be heard by every one the answer is to be counted a failure. I call attention to the fact that there is a great difference between thinking and wondering, and I never allow my students to do any wondering. My class usually is not a very large one, yet I always have a few bashful or deficient students. I give them every encouragement, and before long they manage to do very well.

Dr. E. H. Long, Buffalo, N. Y. The last two speakers have touched upon one feature of teaching that has grown in my estimation year after year, and that is, teaching students to think. One of the greatest faults in the training in our technical and professional schools has been allowing students to give facts without developing in them a corresponding thinking and reasoning power. In anatomy or chemistry there is not much opportunity for the student to reason or think things out, because everything is fact, and each fact must be memorized. But in the practical subjects the teacher should always attempt to train his students to think for themselves; to reason out a question and draw their own conclusions, even though these are at variance with the opinion of the teacher. I always endeavor to present my work in such a way that the student must do some thinking for himself, and not simply answer in a parrot fashion.

I believe that the lecture method is the poorest of all methods of teaching. Of course, it is an easy method of imparting some knowledge, but it is also the poorest because we never know how much the student is learning. In my department—therapeutics—I employ the conference or quiz method as far as possible. I announce that subject to be discussed in advance, then I quiz probably ten men during the hour, giving each time to tell what he knows. I mark them on these answers, giving all to understand that these quiz marks will be taken into consideration in making up their final average at the end of the term. Credit is given as well for reasoning ability as for a knowledge of facts. These conferences are entirely informal and I invite my students to interrupt me with a question at any time.

Dr. Geo. H. L. Wilson, Cleveland, O. Each man has his own method of quizzing. I have a method that has not been mentioned, hence I feel at liberty to give it to you. I do not feel it is wise to quiz immediately after the first lecture, because we have not yet covered much territory and the student cannot have a very intelligent idea of what he is expected to learn. We should cover a large part of the subject, perhaps one-half of the entire course, and then begin to quiz from the very beginning. Use alternate hours for the

quiz and continue until you have covered the subject. The student knows when to expect the quiz, and he knows the work that is to be covered and that it will be taken up in the same manner as the lectures were given. In this way the work is a continuous story and the student can grasp it all, and when it comes to the quizzes he knows that it will be the last time that the subject will be considered before the final examination, and he will give the work his whole attention.

I pursue the method advocated by Dr. Bethel of asking the question first and then calling the name of a student. I notice that most students take down the question, and some are more interested in taking down the question than in answering it. When I see that, I tell them that the quizzes have much to do with the final marking. That if a man is unable to answer in the quiz a certain per cent will be taken off the final average.

I do not believe in the method of recitations *per se* as being the only method of teaching for the reason that the individual who can make the best statement should make it, and that, I believe, should be the teacher. If not, it is very apparent that the teacher is not the man for the place. As comparatively few students can answer well and promptly, I believe in the lecture system of teaching, to be supplemented by quizzes in which the teacher can draw out the student, and correct his mistakes.

Dr. Starr. (Closing the discussion for Dr. Weisse.) This system advocated by Dr. Weisse has been tried for only a short time at our school. Our plan is to bring five or ten men down into the amphitheatre, seat them in front of the examiner, and clear the benches immediately behind them, so that there is no danger of prompting on the part of their fellow students. Each man is quizzed until he fails to answer a question correctly. This method seems to stimulate men to work; it brings forth the spirit of rivalry, and a desire to make a good showing before their fellows. Dr. Weisse said that a student recently answered sixty questions before he failed. It seems to make students more earnest and anxious for the quiz.

The idea of propounding the question first and then calling on the student for the answer is a very good one and worthy of trial. In the New York College of Dentistry under the old method there was little interest taken in the quizzes, and the student, after having been called upon, gave no more attention to what was going on.

The Teaching of Orthopedic Dentistry.

By Calvin S. Case, Chicago, Ill.

Junior Technics.

Realizing, a number of years ago, that college classes in the technics of orthodontia under my direction were obliged to spend too much time on the preliminary work of constructing stock material and implements, and consequently not enough time on the more advanced stages of the technic work that are indispensable to advanced practice in this branch of dentistry, I have for several years put into practice the following rules, with the most marked improvement in the practical training of students:

First—That students should be taught in the technics of orthodontia only that which will be useful to them in actual practice.

Second—That the junior students shall be thoroughly trained in that portion of the technics which they may be called upon to practically apply in their senior infirmary practice.

Third—That the technic work of the class should be thoroughly systematized and pursued along practical lines, and consist in no more work than each student can easily and perfectly perform in two half days of each week for three months.

Fourth—That the principal portion of the technic work shall consist in the construction of practical finished material and appliances to be pre-

sented for grade markings, and become a part of the college stock material for the construction of practical regulating apparatuses in the infirmary practice.

In my opinion, technic students should be drilled in correct methods of obtaining plaster models for study, etc., the separating and measuring of natural teeth for bands, the soldering of bands and their various force attachments, the construction of movable and stationary anchorages, the uses of the draw and screw-plates for the drawing of wire and tubing and the threading of wires and nuts, the threading and tempering of taps, the construction of wrenches and unattached appliances, such as alignment bows, screw-jacks, etc., and the final finishing and plating of appliances.

In my teaching I have abandoned the requirement that students shall roll banding material, because of the meagre facilities for properly performing the work and the time consumed in the attempt, but principally because they will rarely prepare it in practice. The same is true of a large proportion of the other material which we now furnish to the students in a partially prepared state, requiring them to do only that portion of its completion that they would be called upon to perform in practice. The wire and part of the tubing they draw is only to train them in the use of the draw-plate, and is not considered as belonging to the stock, because, unless the wire is drawn through a specially prepared draw-plate, in all probability it will not be the proper sizes for threading in the screw-plate, and, moreover, it would require the frequent use of a micrometer gauge, which students will not buy, to determine and classify the sizes.

Believing that students should be thoroughly trained in the construction of different kinds of regulating bands, fully finished with attachments, that they may be called upon to construct for the regulation of teeth, the technic branch of this work contains all of the kinds that are used for different apparatuses, with full illustrations and descriptions of each. The teacher is expected to select and make chart drawings of the kinds which he wishes his class to make, and to divide the class alphabetically into sections, requiring each student to make at least twelve creditable bands for different teeth.

I would advise that students be required to take the band measurement of the *natural* teeth of the fellow used for the impression. In those cases where this is not possible, a technic rubber model can be submitted. The practical advantage to the student over the ordinary way of allowing them to take the measurements from the plaster models or dummies is quite as marked as it would be in other departments if students could not be supplied with practical infirmary cases, as too frequently occurs in this department. Occasionally, a student will object to the operation, claiming that separating will injure his teeth. But those who have the slightest interest

in the advancement of their fellows or themselves will willingly submit to the unpleasantness; for that is all it amounts to.

The threading and finishing of blank taps, nuts and wires that are furnished to the class in accurate sizes, and the construction of a few kinds of jack and traction screws, will give to the student all the training necessary in this line.

Instead of requiring the student to construct the usual stereotyped regulating apparatus, with training limited to the demand of a few simple irregularities, appliances are now constructed by the entire class with training distributed so as to apply to nearly all characters of irregularity.

If the work is pursued, as it should be, along purely practical lines, it will offer to the student a far more thorough system of training for final practice, with less difficulties and time expended, than has been possible by a regime that requires the complete construction of implements and appliances and a final "show-up" apparatus from the crude material.

True success in teaching every branch of orthodontia which pertains to the construction and action of appliances, whether in practical or didactic instruction, will never be attained without the adoption of some standard system of sizes and the use of a screw-plate that will properly thread the few sizes of wire we require for the work. Then a large proportion of that which we use, or wish to refer to in our teaching, can be numbered the same as the wire for which it is constructed to fit.

In a paper presented at the meeting of this society in 1899 this principle of teaching was advocated, and I am pleased to say that it is now made absolutely practical by the use of the New Standard screw-plate. Heretofore, we have been obliged to draw wires that could be properly threaded in the screw-plates that students would purchase, the most popular of which has been the Martin; and as most of the sizes of the screw-cutting holes in these plates are either a few thousandths of an inch too large or too small to properly thread standard sizes of wire, students and dentists who attempted to make regulating appliances were obliged to redraw commercial wire through a specially prepared draw-plate that was adapted to the requirements of the screw-plate or screw-dies, which they happened to possess. In college work this required the use of an expensive micrometer gauge and a perfect knowledge of the exact sizes they required, a process that could only be determined by the skill of an expert for each of the various kinds of plates in the class, besides many other difficult and almost insurmountable complications.

In the teaching which I propose, the sizes or thicknesses of wire, blank taps, plate, banding material, and the wall thicknesses of tubing, will be recognized as the American (B & S) Standard Gauge sizes; whereas, tubing, screw-plate holes, taps, blank nuts, nuts and wrenches, will take their

size numbers from the respective sizes of wire they are intended to be used with. For instance, a No. 18 wire can be perfectly threaded in a No. 18 hole of the Standard screw-plate; a No. 18 blank tap can be threaded in the same hole to make a No. 18 tap with which a No. 18 blank nut can be threaded to make a No. 18 nut, etc.

When it becomes necessary to speak of any of the above material in our teaching, the mere mention of name and number conveys at once an intelligent idea. Students soon become familiar with the few sizes required for the different appliances, and have a far more intelligent appreciation of the work in its several branches.

Nomenclature. A correct use of terms that could be universally adopted is greatly to be desired in this department of dentistry. At present we are hampered by the use of wrong or ill-chosen terms, which we are often constrained to cling to because of general usage. Again we are unhappily mystified by the ill-advised use of terms which certain prominent writers have adopted in their effort to find words that would more clearly and concisely express their meaning, and also perhaps to simplify that which should be more specifically and scientifically defined.

I would respectfully submit the following terms, with the hope that they will receive your consideration and adoption at this meeting as the standard expressions in this department of dentistry:

Irregularity. The terms irregular and irregularity, refer to teeth that are in malposition in relation to the normal alignment, occlusion, or esthetic contours of the physiognomy.

Alignment. Teeth are in alignment when they are in proper relation to the line of their dental arch. A tooth or teeth in malalignment constitutes an irregularity; yet all the teeth of the dental arch may be in perfect alignment and also irregular, as instanced by abnormal protrusions of the upper, and other conditions.

Occlusion. The terms occlusion and malocclusion refer solely —as in other departments of dentistry—to the occlusion of the teeth, one upon the other. When the teeth are in malocclusion, it certainly constitutes an irregularity; yet in many cases of decided irregularity, the teeth are not necessarily in malocclusion, as is well shown in full protrusions and full retrusions of the upper and lower teeth.

Therefore the terms malocclusion and malalignment when used, as they are by some writers, in place of the terms: "Irregularities of the Teeth," "Orthodontia," or "Orthopedic Dentistry," are ill-advised.

Mesial and Distal. Mesial and distal when used to define malposition, occlusion, movement, etc., will be used only in the sense in which they were originally intended to be used in dentistry, i. e., toward or from the median line, in a direction along the line of the dental arch. Therefore they should not be used; as they frequently are, in the sense of anterior and posterior, front or back, or protruded and retruded. If "the upper first molars occlude mesially to normal in their relations to the lowers," this irregularity should not be defined as one "in mesial occlusion" and vice-versa, because occlusion is a word which has reference to the lower teeth as well as the upper in occlusal contact; therefore, the irregularity might as well be defined as one in distal occlusion. Again: The mesio-distal relation of the molar occlusion in no sense defines the real irregularity, because this relation does not necessarily indicate that the upper teeth are protruded or retruded, for the fault may be entirely with the lowers; or it may be partly with the lowers and partly with the uppers, etc. The real irregularity in these conditions can only be determined and defined by a careful study of the position of the teeth in relation to the features of the physiogomy.

Arch. The dental arch is that inscribed by the teeth. The *alveolar arch,* that inscribed by the alveolar process and overlying gum.

Zone. Zone is a favorable word for locating sections of the dental and alveolar arches that we frequently wish to refer to in describing different characters of general malpositions and movements; as, occlusal or incisal zone, gingival zone, and apical zone.

Compound Terms. The adjectives, *mesial, distal, labial, buccal, lingual, occlusal,* and their combinations, can be happily used to exactly define certain malpositions, movements, points of attachment, direction, etc.

The direction in which a tooth is mal-turned or rotated may be perfectly defined with a compound word if it is understood that the first member of the term refers to the surface of the tooth and the second to the direction of its malposition or movement. Thus, teeth are mal-turned, rotated, or require to be rotated, linguo-mesially or linguo-distally. Again, a tooth may be in mesial, distal, labial, buccal or lingual *inclination,* or in labial, buccal, or lingual *malalignment,* etc., etc. The malposition of an upper left lateral incisor that is said to be mesio-labially inclined, linguo-mesially mal-turned, and in labial malalignment, is not difficult to see "in the mind's eye."

Anterior and Posterior.

Anterior and posterior are words that are so well established by common usage, that it would be difficult if not impossible to drop them wholly from our nomenclature, as much as we would wish to. When used to define relative position or movement in a direction parallel to the median line of the dome, they are frequently of great advantage. In referring to general relations, it is far more sensible to say the "antero posterior relation" of the upper and lower sets of teeth than the "disto-mesial relation," because the latter words could refer only to the molars or biscuspids in the direction of front and back; though if wishing to refer only to the relation of the buccal teeth, the term "mesio-distal relation" would be preferable.

Protrude and Retrude.

The syllable "trude" (from trudo, to thrust) with certain prefixes, as Pro (forward), Re (back), Ex (out from), In (into), and Con (in upon), gives us a class of words of distinct and scientific meanings. Teeth are protruded or retruded only in respect to their normal facial relations, and in no instance can this be determined or defined by the occlusal relation, as some writers imply.

Extrude and Intrude.

Extrude and intrude apply to teeth which are not in proper relation to the normal occlusal plane, and commonly spoken of as teeth that are too long or too short. The terms will be used particularly to define malposition of one or more teeth whose occlusal surfaces or incisal edges are not normally even with those of their adjoining fellows. When the condition involves all the front teeth, it will of course constitute an "open or close bite irregularity" though correction may be properly defined as the partial intrusion or extrusion of these teeth.

It is frequently desirable to speak of the six front upper or lower teeth as having moved or requiring movement, in phalanx; the same is true of the right and left upper and lower side teeth; therefore the term, *"Labial Teeth"* may be used to refer to the incisors and cuspids in single phalanx; and "Buccal Teeth" to the bicuspids and molars in single phalanx.

In referring to the general location of teeth, would it not be decidedly advisable to say *front* or *back* teeth instead of anterior or posterior teeth; and *upper* or *lower* teeth, instead of superior and inferior teeth?

Mal-turned and Rotate.

When a tooth is abnormally turned on its long axis it is "mal-turned." The term "rotate" and its suffixes refers preferably to the act or need of turning it.

Classification. The teaching of the department of orthodontia has been especially difficult because of the almost limitless variety of malpositions which irregularities of the teeth present, and particularly because irregularities of the teeth have never been systematically nor scientifically grouped so that one could talk or even think of them as belonging to a class or type that required a certain order of treatment, or that differed from other classes because of certain recurring important variations, or that produced a certain facial deformity or effect, that differed from others whose teeth seemed to be in the same relative position.

In my opinion it is unfortunate that the last two text books written upon orthodontia place all irregularities of the teeth in three classes, divided and grouped according to the disto-mesial occlusion of the first permanent molars. That is to say; all irregularities of whatever character which occur with the molar occlusion typically normal are placed in one class; those which occur with the upper first molars occluding mesially to normal in relation to the lower, and *vice-versa,* are placed in the second and third classes respectively.

At the last meeting of the Illinois State Dental Society, I was constrained to present my opinion of this method of classification; and in detail I explained how the first class selected upon the basis of a typically normal molar occlusion must of necessity contain five distinct varieties of general irregularity, which differed in almost every respect from each other. I also claimed on that occasion, that the second and third classes, if grouped on the basis of the above conditions, would be found equally faulty when considered in the light of a classification designed for the information and practical advantage of students and busy practitioners.

To more fully illustrate the purposes of this paper, which is purely a discussion of the choice of methods of teaching, and to not repeat that which has already been published, I will take the liberty of showing the different distinct types of irregularity of the teeth which we would be obliged to place in the second class, grouped on the basis of the upper molars occluding mesially to normal in relation to the lowers.

These constitute seven common irregularities that are distinctly different from each other, both as to their relation compared to the normally esthetic, and the movement which they demand for correction.

In going into this branch of the subject I trust that it will not be considered solely in the sense of a criticism. I introduce my views mainly to illustrate the principles I shall propose, which should govern classification, fully conscious that the advancement of every science has always been through a pathway of errors and that we should look upon them only as stepping stones to our progress.

To show how impossible it is to determine the real character of an irregularity of the teeth as a guide to treatment by the relations which the upper and lower teeth bear to each other, I will ask you to glance at the lantern projections of five cases from practice. (See Fig. 1.)

If you had the plaster models of these cases for careful examination, you would say they are very like each other in all general relations; the same apparent protrusion of the uppers in relation to the lowers; the same disto-mesial relation of the first molars—the upper standing about the width of a biscupid in front of a typically normal occlusion with the lower.

Case 1. Case 2.

Case 3. Case 4. Case 5.

Perhaps you will notice that in some of the cases the teeth are more labially inclined than those of the others, but this often occurs in two cases of the same facial deformity because of the unequal thickness or disposition of the overlying tissues which aids in characterizing the facial contours; with the same argument you might notice that there is a slight but noticeable difference in the occlusion of some of the cases; and yet if they produce the same facial deformity I claim they should be placed in the same class, because the movement required for their correction and

the particular force which the regulating apparatus should exert would be practically the same. It happens that these cases to which I have called your attention belong to five distinctively different types of facial deformities, requiring for their correction decidedly different movements of the teeth and consequently different orders of force apparatuses. (See Fig. 2.)

Taking them up in detail: The *first* (See Fig. 3) is the most common form of upper protrusions, which require for their correction a retrusion of the crowns of the six upper front teeth.

Fig. 2.

The *second* (See Fig. 4) differs from the first in that the roots of the front teeth are also protruded, producing a greater prominence or bulginess along the upper part of the upper lip and around the wings and nostrils of the nose. These cases require for their perfect correction the retrusion of the roots as well as the crowns; an operation that can only be successfully accomplished with a specially constructed apparatus that is entirely different from that required in the first form. Notice, if you please, the intermediate stage of the operation. Up to the time when these intermediate models were made, the patient had been wearing an apparatus

which applied a single force near to the gingival margins of the teeth, with the view of distributing the movement to the roots, or as much as it is possible to do so with force applied at a single point upon the crown. And yet we can see, with the crowns alone retruded, that the protrusion over the apical zone is even more marked than it was at first. The final re-

sult, shown by the models on the right, was obtained with an apparatus specially designed for retruding the apical zone of the incisor teeth, which, as will be seen, reduced the unpleasant prominence along the upper part of the upper lip.

FIG. 4

The *Third* (See Fig. 5) is a protrusion of the upper teeth, and a retrusion of the lower, another marked differentiation in character and demands.

The *Fourth* (See Fig. 6) is a retrusion of the lower teeth, with the upper normal; a not uncommon irregularity that is widely different from the first in which the upper alone was protruded.

The *Fifth* (See Fig. 7)is a compound irregularity, which in its most marked form produces a depression along the upper part of the upper lip, with a deepening of the naso-labial lines and a protrusion of the lower part of the upper lip. In these cases the general inclination of the uppers may differ somewhat without changing the peculiar characteristics of the class, which are: a retrusion of the apical zone and a protrusion of the occlusal, demanding an apparatus that will protrude the roots and retrude the crowns, or the protruding contour apparatus, with a movement that is entirely different in its demands and action from either of the others.

It is not presumed that these marked characteristics will always be found in the pronounced forms of the cases I have shown, but in all varying degrees in the antero-posterior relation of the upper to the lower teeth, and also to the unchangeable features of the physiognomy. In other words, the peculiar characteristics which I claim constitute a class may be found merging into that of another class, requiring an intelligent appreciation of the real condition and demands of treatment that cannot be

FIG 6

gauged by cut and dried rules. It seems to me, however, of eminent advantage, especially in our teaching, to have these division guide-posts of class characteristics to work to or from, instead of placing distinctively different irregularities in one class because they happen to be alike in the single particular of molar occlusion; especially as this tells us nothing of the real condition, nor points the way to its correction.

The *Sixth* (See Fig. 8) typical character with the same occlusion of the first permanent molars, is the inherited bodily retrusion of the lower

eruption of the second molars an attempt to retrude the buccal teeth would be a very questionable undertaking, especially if it was demanded that the entire movement should be confined to the uppers, as it certainly would, if the lower teeth and jaw were perfectly normal in their relations.

The diagnosis and prognosis of these cases is often very difficult, and can only be determined by a careful study of occlusion and dento-facial relations, together with a perfect appreciation of the developing influence of growth.

FIG. 9

In my classification, this character of irregularity constitutes a class to distinguish it from that most common and similar form which demands correction without extraction.

It will have been noticed in all the seven cases which I have presented, that the upper molars occlude mesially to normal in relation to the lower about the width of a bicuspid, and that the different distinct types of irregularity which may occur with this occlusion differ from each other in char-

acter and demands for correction, quite as much as it is possible for them to differ in these particulars from the several distinct types that occur when the occlusion of the molars is normal and also distal to normal in relation to the lowers.

Then why call them a class? It is certainly a very simple method of disposing of the classification of irregularities of the teeth, and one doubtless that will appeal to many because of that fact alone. But is it scientific? Is it useful? Do these particular signs of occlusion or malocclusion in themselves indicate the character of a certain irregularity, or the movement demanded for its correction? Certainly not, if the other two so-called classes are as misleading as the one I have shown; and I am sorry to say that they are when considered in the sense of a classification designed for teaching or practice.

Again I wish to say that the only object of this showing is to emphasize the importance of a classification of irregularities that is governed by the same rule that governs scientific classification in other sciences, viz.: one that is founded upon an experienced recognition of distinct recurring varieties which constitute the general forms or characteristics peculiar to the class. In orthopedic dentistry this would mean—an intelligent grouping in each class of recurring malpositions or dento-facial deformities that are distinctly peculiar to the class, and that require for their principal correction a similarity of movement.

In the classification which I propose and present for your consideration, irregularities of the teeth are first divided into two general divisions:

In the *first* division are placed simple and complex irregularities that are purely dental in character and which cannot be scientifically classified according to the above rule because of the fact that nearly every case is composed of two or more distinct varieties of malpositions.

In the *second* division are placed distinct types composed principally of dento-facial irregularities that are susceptible of being properly classified.

The *first* division includes by far the more common forms of irregularities; and while there is no case however apparently simple in which the type and peculiarities of the physiognomy should not be carefully and intelligently observed this division is supposed to contain only those strictly dental irregularities that produce no marked facial imperfection, and which if properly corrected without extraction or abnormal absence of any of the teeth will result in normal occlusion.

For teaching purposes I have divided them into five groups, according to the five distinct malpositions that require a similarity of movement and force appliances, as follows:

Division 1.—Simple and Complex Dental Irregularities.

Group I. Intrusions and Extrusions.

Group II. Labial and Lingual malalignments, including crowded complications.

Group III. Mal-turned Teeth.

Group IV. Contracted and Expanded Arches.

Group V. Wide inter-proximate spaces between Front Teeth.

By segregating the above malpositions, two or more of which might occur in any practical case of complex irregularity, I am able to show to the entire class, by lantern projections, the different malpositions which each group may assume, together with the appliances and peculiar force that is applicable for correction.

In the *second* division, or classified irregularities, the general malposition is distinctively characteristic of the class, or one of its variations; and while it may contain minor complications, the principal methods ot treatment will be the same in every case.

With the exception of Class 1st and 2d, they are divided according to the peculiar facial deformity or imperfection which the irregularity produces; and even with Class 1st and 2d, diagnosis with a view to treatment is dependent solely upon an intelligent consideration of the relations of the teeth to the physiognomy and the harmonizing influences of maxiliary and facial development.

Division 2.—Dento-Facial Irregularities.

Class I. Labial mal-eruption of the upper cuspids that demands correction without extraction.

Class II. Labial mal-eruption of the upper cuspids that demands extraction of bicuspids in correction.

Class III. Protrusion of the crowns of the upper front teeth.

Class V. Protrusion of the crown and retrusion of the roots of the upper front teeth.

Class VI. Protrusion of the roots of the upper front teeth, with occlusal zone normal or retruded.

Class VII. Protrusion of the upper teeth and retrusion of the lower.

Class VIII. Retrusion of the lower teeth and upper normal.

Class IX. Retrusion of the upper teeth and protrusion of the lower.

Class X. Retrusion of the upper teeth and lower normal.

Class XI. Full protrusion of the upper and lower teeth.

Class XII. Full retrusion of the upper and lower teeth.

Class XIII. Bodily protrusion of the lower teeth and jaw.

Class XIV. Bodily retrusion of the lower teeth and jaw.

Class XV. Open bite irregularities with various antero-posterior relations of the upper and lower teeth.

The large number of classes into which I have divided typified irregularities may lead one to infer, as a certain writer did in criticising Dr. Goddard's classification as compared to the three class scheme—that we proportionately increase the difficulties and complications of practice and teaching. The writer thought he could understand and practice orthodontia far more successfully with only three classes of irregularities, the characters of which could be easily distinguished by the simple occlusion of the first molars, than it would be possible with a classification that divided irregularities into a dozen or more classes, each one of which required for its recognition and treatment a complicated study of dental and facial relations. Such a person could also more readily understand and practice medicine if there were only three classes of diseases, which could at once be easily recognized by a simple and definite sign. But it happens that the sciences of medicine and dental orthopedia are not so accommodating.

If the different distinct types of irregularity of the teeth which I have shown, arise in practice, and if it be true that they cannot be properly classified or treated on the basis of occlusal relations, should not the student of our dental colleges whose curriculum includes orthodontia have a right to demand full and perfect instruction in this department?

By bringing together the same conditions that dentists have been treating since the practice of orthodontia began, and by separating them so as to place in each class a definite type that demands for its correction a certain movement or character of force that differs from all the others, we have endeavored to present a classification that will enable us to recognize these conditions and more clearly define, teach and practice orthopedic dentistry according to correct principles of science and art.

It does not make it any easier to be told that a protrusion of the upper front teeth and a retrusion of the lower teeth and other conditions more widely different, belong in the same class, to be treated by the same apparatus and character of force. It might serve to induce certain ones to undertake a difficult operation, but I doubt its simplifying influence to one who can appreciate perfection and who is striving for correct practice.

In arranging the sequence of the classes, I have endeavored to present them in the order of their relations; but there is no objection to interchanging, dividing or adding to the types, provided that the rules are preserved that should govern classification. In speaking of different types it is not expected that they will be defined as belonging to a certain class number without other qualification, unless for reference or abbreviation of that which is shown or understood, as this would involve memorizing the order of sequence.

In presenting the different classes with the view of teaching diagnosis and treatment, lantern slide projections of drawings which mechanically illustrate the character of the irregularity in its typical form, the occlusion, facial relations and effect are thrown on the screen; different views of the apparatus on the teeth, and finally disassembled and shown in parts. This is followed with lantern slide projections of the models of practical cases belonging to the class.

I have long believed that we will never arrive at the perfect teaching of orthopedic dentistry until text books are written relative to the practical technics of the work, that will enable us to present this portion of the didatic teaching in the form of recitations instead of the usual stereotyped lectures.

With the latter method the student comes to the class usually with no knowledge of the subject that is to be presented; and when he leaves he is more often than otherwise in a mystified condition of mind, so that the little knowledge he has gained will not stay with him long; and as it is impossible for more than a few to take intelligible notes of that which has to be taught with blackboard drawings, charts and lantern slides, relative to the various forms of irregularities and the construction and application of methods for their correction, the final result of our work on the candidate for graduation is something which we too often are obliged to simply close our eyes to.

With the method I propose, the student would be able to come to the class fully prepared to answer all questions relative to the character or characters of irregularity and their treatment that were selected for the hour, illustrations of which are thrown upon the screen.

If these are presented in a perfect sequence of arrangement, properly grouped and classified, the student is kept in intelligent touch with the teaching from the beginning to the end of the course.

During the progress of this portion of the course, the teacher can amplify the work with his individual experience in similar cases, or the methods of others which he believes to be more practical, and other knowledge of importance not mentioned in the text.

Orthodontia Technology.

By S. H. Guilford, D.D.S., Ph.D., Philadelphia, Pa.

In the teaching of orthodontia it is extremely important that we should have a correct understanding of certain principles involved and the practical application of such principles.

Extraction.

One of the questions that arise early in the course of our teaching is "Shall extraction be resorted to in our efforts to align a malposed set of teeth, and if so, under what conditions?"

It has generally been granted by those teaching and practicing orthodontia that in a rather limited number of cases extracting will often simplify and therefore expedite the operation without detracting from the beneficial results obtained.

But this theory, which has prevailed for a long time, and which seemed to be sanctioned by experience, has recently been attacked by certain men who contend that extraction need never be resorted to and that its practice in orthodontia is little less than a crime. Some even go so far as to assert that it is never productive of good and that in all cases it results in harm.

On this account it behooves us to consider the matter at this time in order to determine, if possible, which is the better course to pursue.

It is rather a broad question to ask, "Shall we extract, or shall we not?" for so much depends upon the condition to be corrected and upon the tooth or teeth which it is proposed to sacrifice.

In nearly all of the writings of the extremists who hold to the non-extraction doctrine it will be found that their contention is against the extraction of the permanent first molar.

This seems like begging the question, for I presume every one in this assembly recognizes the great importance of this particular tooth in the arch; its serving as a guide to the proper alignment of the other permanent teeth as they erupt; its important service in mastication during the changes accompanying second dentition, and the harmful results of its loss in allowing the other teeth to wander from their normal positions.

For these reasons and for the additional one that its extraction cannot assist in providing space for crowded teeth in the anterior part of the arch, none of us either advocates or practices the extraction of this tooth.

Neither would we sanction the extraction of any of the six anterior teeth in the upper arch for the reduction of irregularity in that region, but

when it comes to the question of preserving all of the teeth and thereby having an undue prominence of the upper arch, or, the extraction of one or both first biscupids to provide space for bringing such teeth into alignment and thus avoiding protrusion I take it that nearly all would agree that the latter course is the better one to pursue.

In patients over fifteen years of age where the alignment and relation of both upper and lower teeth on one side of the arch are normal and where, on the other, either a lateral incisor or a cuspid has been crowded out of its normal position and where, in addition, the anterior teeth do not call for protrusion, would it not be in accordance with the dictates of wisdom and prudence to extract the first bicuspid to provide space, rather than to disturb the entire line from central to second molar in order to avoid extracting?

FIG. I

Is it advisable in a majority of cases to perform a simple operation or a complicated one, where the results can be made satisfactory by either?

The extremists claim that whenever extraction is resorted to there can never be an absolutely perfect alignment or relation between the upper and lower teeth.

This is certainly true but may we not, in many cases, after limited extraction, have a very good occlusion and one that will perfectly satisfy all the demands of mastication and probably those of appearance?

It is very well to strive after perfection but do we ever attain it?

I would not be misunderstood in regard to the matter of extraction for where it has been resorted to on a large scale or even injudiciously on a small scale the evils that have followed in its train have been almost numberless and very deplorable, but under certain conditions and within proper limitations I believe it to be entirely justifiable.

To teach students that extracing for correction should never be prac-

ticed would be simply leading them into a maze of difficulty and virtually inducing them to attempt complicated operations that would surely invite failure.

On the other hand to lead them to infer that it should be resorted to in many cases, or for the simple purpose of rendering operations less difficult would be doing them equal injustice.

The proper function of teaching should be to instruct students not only as to the How, but as to the When and Where.

In support of the position that extraction is, in some cases, not only justifiable but advisable I would ask you to look at the representation of two cases in each of which a first bicuspid has been extracted to correct an irregularity which would otherwise have involved long and difficult treatment, with, possibly, less satisfactory results.

FIG. 2. A

FIG. 2. B

Cases from Practice.

In Fig. 1 you will notice that on one side the teeth occlude fairly well while on the other side the lateral is malposed lingually and the cuspid buccally. Owing to this irregularity the upper and lower posterior teeth on that side are not in normal relation either before or after correction, and yet they occlude in such a way as to render perfectly satisfactory service in mastication.

As there was neither protrusion nor retrusion of the upper or lower anterior teeth, but instead, a normal relation, to avoid extraction in this case would have required the moving posteriorly of both bicuspids and molars. Would this have been a very difficult operation or otherwise, and if accomplished would the aesthetic improvement of the case have been sufficient to compensate for the time, difficulty and discomfort involved?

I leave it for you to answer.

Fig. II. A and B represents a case similar in many respects to Fig.

1. The original models are missing but they showed perfectly normal relation and occlusion on the right side, while on the left the lateral was misplaced lingually and the cuspid labially. The first molar on the left had been extracted before the case came to me, but by moving the bicuspids posteriorly space was created to enable the malposed teeth to be brought into position. Here a mistake had certainly been made in the extraction of the molar, and yet, as you will see, the result is satisfactory, for while the occlusion on that side is not strictly normal it is still sufficiently good for serviceable mastication.

I think that none of us would have advised the moving posteriorly of the second molar because it happened to nearly occupy the position of the

first molar and then to have inserted a substitute for the missing first molar, and yet something analogous to such a procedure has been advocated in the journals.

Fig. III shows models which were sent to me for advice. The child was said to be fifteen years old. As you will observe, both of the superior laterals are misplaced lingually and the left cuspid buccally. The median line is also slightly to the left of its normal position. The relation of the upper centrals and the lower incisors is so nearly normal as not to call for any material change. A slight movement labially of the superior centrals would allow the right lateral to be brought readily into alignment, but to provide sufficient space for bringing the left lateral and cuspid into position would require excessive protrusion of the incisors, the retraction of both bicuspids and molars or the extraction of the first bicuspids on that side.

Should we advise the extreme protrusion of the incisors or the retrusion of all the buccal teeth rather than the extraction of the first bicuspid? I should say, "No."

Fig. IV represents a case in which the superior first bicuspids were extracted eight years ago to afford room for bringing into alignment the lateral incisors which had erupted labially and were considerably turned upon their axes. The patient was then seventeen years of age. The centrals above were in proper relation with the lower incisors. The overbite was normal, and there was neither protrusion nor retrusion of any of the anterior teeth. The bicuspids and molars, however, owing to the opportunity offered by the misplaced laterals had moved forward the full width of a bicuspid.

In this case, the problem presented was that of moving backward all of the buccal teeth on each side, or the excessive protrusion of the anterior teeth or the extraction of the first bicuspids.

FIG. 4

To have protruded the anterior teeth would undoubtedly have created a deformity of the features; to have moved the buccal teeth backward would have been an Herculean task if not an impossibility at the patient's age. As you will see by the models I attempted neither but removed the first bicuspids instead and brought the laterals and cuspids into line.

The second bicuspids and both molars were not disturbed so that they remain in positions anterior to normal and yet observe how well the teeth interlock and how thoroughly efficient they are for purposes of mastication.

Besides this her features are in perfect harmony and I fail to see how they could have been further improved.

Occlusion.

The question of extraction is naturally very closely related to what is commonly known as occlusion, and before entering upon a consideration of this second phase of our subject let us pause for a moment to consider the appropriateness of the term, for teachers should be exact with regard to the terms they use if they wish their students to be able to express

themselves properly. We claim to be teaching a science, but one of the great features of any science is a correct terminology.

Occlusion, when used in connection with a mechanical action means "a closing or shutting up."

Occlusion, in dental science means the closing or coming together of the teeth. When the upper and lower teeth are not in contact there can be no such thing as occlusion.

The teeth, if normally placed are in proper relation all of the twenty-four hours, but they are in occlusion probably less than one hour of that time. Why then speak of the occlusion of the teeth when we mean their relation to one another?

If the teeth are in normal position the occlusion cannot be otherwise than correct.

The relation of the teeth determines the occlusion, the occlusion determines nothing, for it is simply a coincident condition. As a term used to express the relation of the upper to the lower teeth it is faulty, and its employment is made more objectionable when we read in books and in print such expressions as "a cuspid erupting in labial occlusion" or "a lateral in lingual occlusion" when these teeth are not and cannot be in occlusion on account of their abnormal positions.

"Labial or lingual misplacement" would be a better term and "normal relation" is an expression which fully and correctly describes the teeth when they are in such positions as nature intended them to be.

Some recent writers have made the statement that the natural relation between the upper and lower teeth is determined by the position of the first molars above and below. That when these meet each other in a normal or natural manner the rest of the teeth must come into proper relation. In other words, they claim that the first molar is the key to a correct or incorrect relation of the other teeth.

Certainly if the teeth in one or both jaws are in normal position the first molars will be in proper relation to one another, but does it follow that because these two teeth occlude properly the others must likewise do so? I think not. Why take the first molar as a key? Goddard says that the lower second bicuspid is the "key to occlusion." Which shall we accept, the first molar or the lower second bicuspid? One is as near right as the other, in my opinion.

More than this, who will tell us when these teeth are in their proper or normal positions? Is it when the anterior buccal cusp of the upper occludes between the buccal cusps of the lower? So say the extremists, but it is a well known fact that in certain cases these teeth interdigitate normally when they are in an advance position as compared with those of some other jaw which also interdigitate normally.

To locate these teeth properly we should know definitely their real anatomical position. This could only be done with exactness by determining the distance that this tooth should be from the median line in front and the tuberosity behind. Has this been determined?

In view of this how can anyone lead himself to believe that the relation of the first molars necessarily determines the irregularity; that in any case of malposition the first thing to be done is to bring the molars into proper relation and that after this is accomplished the remainder of the operation will be comparatively easy?

Retentive. Another error has found lodgment in the minds of some of our profession, especially the younger portion. It is that when the upper and lower teeth have been brought into proper relation the interdigitation of the cusps of the bicuspids and molars will, of itself, prove sufficiently retentive to prevent subsequent displacement.

If the teeth were constantly in occlusion or if they were so for any considerable portion of the time, they would undoubtedly prove sufficiently retentive, but as they are so only at intervals and then mostly during the act of mastication this influence must necessarily be a very limited one. No, the buccal teeth themselves are kept in their normal relation not so much by their interdigitation as by the fact that they stand in a solid phalanx and that one cannot move without displacing the others which would almost be a physical impossibility. Besides, how can the proper relation of the buccal teeth influence the anterior ones in cases of protrusion?

When these anterior teeth are retruded will the normal relation of the buccal teeth keep them from again moving forward? Certainly not.

As teachers, it becomes our duty to see that the younger generation of practitioners do not imbibe erroneous ideas and that they are not led astray by false theories.

This matter of occlusion, or more properly, relation of the teeth, is of the greatest importance and we should have correct and scientific principles to govern us in its consideration. These principles are not new, they have been enunciated by all writers on orthodontia from Kingsley down. They simply need, at this particular time, to be sufficiently emphasized.

Firm Anchorage. Suitable and positive anchorage for the movement of the teeth is a matter of the greatest importance, for a lack of knowledge concerning it has undoubtedly been the cause of many sad failures.

Time will not permit us to consider the many ways in which anchorage may be obtained in various cases but I desire to bring into prominence the basic principle involved in all.

The truth of the principle that "the point from which we exert force

must greatly exceed in rigidity that of the object to be moved," is apparent to any one having even a rudimentary knowledge of dynamics and yet, strange to say, this principle often seems to be lost sight of in the devising of apparatus for the correction of irregularities.

Even though a multi-rooted tooth will offer far greater resistance to force applied than the majority of single-rooted ones, it is never safe, and hardly ever permissible to use a single tooth for anchorage.

The tipping or even slight movement of a tooth used as anchorage is not only a serious matter in itself, but it frequently complicates and sometimes absolutely negatives the good result sought to be attained.

Furthermore, there is no occasion for assuming the risk that is thus involved unless it be the desire to avoid the labor of special construction and employing instead the adjustable "clamp bands" or other "ready to wear" appliances for sale at the supply houses.

Parts of appliances of various forms and sizes are placed on sale and recommended as suitable and sufficient for all cases presenting, but a combination of parts such as are required for correct anchorage are not offered because such combinations cannot be made except for the case in hand. It is for this reason, probably, that the designers of the marketable products strive to find an excuse for single-tooth anchorage.

Even the use of a long tube to a single-tooth band (as somewhere suggested) will not entirely prevent the tipping of the tooth although it may measurably retard it.

When the anchorage is limited to one side of the arch as it usually is in the movement of an anterior tooth either forward or backward in the line of the arch, the combined resistance of both molars or a bicuspid and molar should be taken advantage of and even then greater firmness will be gained by placing the bands on alternate teeth, as for example, the second bicuspid and second molar. And where anchorage on both sides of the arch is required as in moving the anterior teeth "in phalanx" the same method is employed on each side.

Construction of Bands.

It is sometimes difficult, where the second molar has not erupted to its full extent to place a band upon it in connection with a similar band on the first molar or second bicuspid, but the exercise of a little ingenuity will usually overcome the difficulty.

With two posterior teeth banded and these bands connected by the long tube which is to accommodate the screw or bow-wire intended to exert its force upon the anterior teeth we secure as stable an anchorage as it is possible to obtain under the circumstances.

In the making and arrangement of bands which are to serve as the basis for the construction of anchorage appliances some operators construct

them upon the plaster model, while others for the sake of greater accuracy, construct and fit them to the natural teeth while the patient is in the chair. One plan has the advantage of relegating part of the work to the laboratory and thus conserving the time of both practitioner and patient, while the other possesses the advantage of a more certain fit and greater accuracy.

Both of these advantages may be combined by the use of German silver bands made from seamless tubing drawn to various diameters and of varying gauge.

After taking the usual preliminary impression and deciding upon the teeth to be banded, unannealed bands of gauge 36 are selected of suitable size and forced over the teeth to remain until the following sitting. In the meantime, annealed bands of exactly the same size are fitted over the corresponding teeth on the plaster model and the further construction of the appliance proceeded with. The bands placed upon the natural teeth and forced between them and the adjoining ones will be found, by the second sitting, to have provided sufficient space, painlessly, for the placing in position of the operating appliance.

By this method time is saved, accuracy is obtained and the patient is freed from unnecessary annoyance.

Samples of these bands, fitted to the teeth and connected by tubing are shown on the dummy jaw herewith presented.

Discussions of Papers by Drs. Case and Guilford.

Dr. A. E. Webster, Toronto, Ont.

To discuss a paper such as the one read by Dr. Case is a privilege. It conveys a complete idea of the points to be considered in a course in orthodontia. As a pupil of Dr. Case, and as a close observer of his methods, I have nothing to say that is not commendatory of what he has done for orthodontia. It must be those who make a specialty of any department of dentistry to whom we must look for advancement; but we must look to those who do not practice specialties for the learning. There is always the danger of a specialist being carried away with a notion of the over-importance of his subject. While this may apply to some of those who are practicing orthodontia as a specialty, it can in no sense apply to the essayist.

I am in perfect accord with the four propositions set forth by the essayist in introducing the subject. As little time as possible should be spent on the manufacture of stock materials. It will suffice to familiarize the student with their main characteristics. It is much more important for a student to acquire manipulative dexterity while making something useful, than in doing dummy work. It gives his work interest. For the past four years orthodontia technic has been taught in the Royal College of Dental Surgeons, in the manner outlined by Dr. Case, making such modifications as the conditions of the curriculum of the college demands. The results have been fairly satisfactory, but not all that could be desired. There is no fault in the general plan, but with the present manufacturers it is impossible to carry it out. As stated, the foundation principle of comfortably carrying out any method of teaching this subject, is a uniform system of measurement, and then to have the partially prepared materials made to suit these conditions. Up to the present time I have found no satisfactory screw plate. The holes are not uniform in size, the threads are

not always well cut, nor of the same number of threads to the inch. There are no draw plates with the proper sized holes to correspond with the screw plates. And even if they were made so, they would soon wear by use until they would not correspond. Any tap blanks and drills we have been able to get are so variable in size that they are an eternal nuisance. One almost slips through the screw plate without cutting a thread, while the next one will not enter at all. The square tubing for nuts has such a large hole in it, that the smaller sized nuts cannot be made from it. If these and other difficulties of detail could be overcome, it would be a pleasure to teach orthodontia technic as outlined. It is the exactness in detail that leads to success in this subject more than in any other department of dentistry. When these partially prepared stock materials are accurately prepared the greatest difficulty in teaching orthodontia technic shall have passed away.

Terminology.

I agree with the essayist that there should be a uniform nomenclature and a much more comprehensive and accurate one than has been in use. There are many malpositions of teeth that cannot be accurately described without a cumbersome circumlocution, and there are words borrowed from other departments of dentistry, that do not convey an accurate idea. While the essayist has carefully defined some words, he has in other cases attacked words which express a definite position of a tooth, or number of teeth. If there be an objection to saying that a tooth is in "mesial occlusion" how better is it to say "anterior relation." Anterior relation to what? They must be anterior to something. If normal is meant, why not then say, mesial to normal. The difficulty is quite clear to anyone who has ever attempted to analyze these terms, and the classifications made in our modern texts. But the substitution of anterior and posterior for mesial and distal, does not get out of the difficulty. All of these terms express relation and the whole difficulty can be gotten around by basing the classification of irregularities and the positions of the teeth on the physiognomy. For example: There are normal profiles, there are protrusion and there are retrusions. This brings me to the classification, but before discussing that let me say, that there is a serious objection to saying mesial occlusion, or lingual occlusion, or labial occlusion. But there can be no objection to saying mesial position, or lingual position, or labial position.

I may start out with the statement that I am not in accord with any classification of irregularities that I have ever seen; not even the one in use in our own college. But I must say for it, that there are fewer objections to it than to some others. The status of any subject can be judged by the accuracy and completeness of its classifications. Thousands of pages of more or less useful literature were written on orthodontia before any classi-

fication was ever attempted. As the knowledge of the subject advances, so will the classification. The putting of names on certain existing conditions, is like naming holes on a golf course. The name should be based on some characteristic of the condition. Classifications of diseases in general medicine are based on anatomical locations, pathological manifestations, etiological factors, symptomatology and only very rarely upon treatment. Any classification which is partly based upon anatomy, and partly on symptoms and partly on treatment is not logical. The whole of any classification should be based on the anatomy or on the pathology, or whatever masis is chosen. To base a classification on treatment, is surely not scientific, or to criticize another classification because all the irregularities in one class are not corrected by the same force or appliance, is far wide of good criticism. We know quite well that the treatment for malaria is quinine, and yet it would hardly do to class this as a disease, simply because quinine will cure it. Classifications should be made having in view the etiology and pathology. And until something is known of the etiology of irregularities no acceptable classification will ever be made. A classification based upon the pathology alone does not suggest the treatment, while if based on the etiology the treatment is suggested.

Normal. Protrusion. Retrusion. Apical. Incisal.

The classification presented by the author is simply naming conditions as they present; to make it comprehensible it might be well to divide facial deformities into protrusion and retrusion, each with the modification of apical and incisal protrusion or retrusion. While Dr. Case's classification can be studied out, yet it can be more easily understood if they were extensions of an original type. The objection in chief is the basing on treatment and not showing the relation one bears to another. The classification which Dr. Case combats in his article is perhaps as defective as it is possible to be.

I quite agree that there should be a text book on orthodontia, written in a way that certain conditions might be carefully read before a lecture is delivered on the subject.

Dr. Guilford's Paper.

In Dr. Guilford's paper there is a plea for the teaching of correct principles; no more useful plea could be set forth. Perhaps fully seventy-five per cent of all cases of orthodontia attempted might about as well have been left alone. The difficulty is that correct principles are understood by only a few who practice orthodontia. What are correct principles in extraction, for example? There are those who live and teach even in the year one thousand nine hundred and three, that the first molars should be extracted, to correct defomitites in the anterior part of

the mouth. Some advocate symmetrical extraction. These were thought to be correct principles years ago, but not so now. Unfortunately orthodontia is not yet on a scientific basis. It is always this or that man's practice that is being discussed, the subject or the principles of orthodontia are only incidental to the discussion. To illustrate, in America the disciples of Jack would not use anything except spring wires, those of Angle, the clamp band and the outside bar. There are those again who see no good in either bands, nuts, screws or springs; the plate is the only thing. It will take years to sift out the best from all these.

How can correct principles be taught when we do not know the causes which lead to the deformity? Do we really understand what forces direct the teeth into their normal positions and retain them? But vaguely, I think. Then how can we know the cause of even the simplest case of deformity, much less how to treat them; and to treat a disease without knowing the cause is mere imposition. I once heard a prominent teacher of orthodontia say, that he did not care a whit about the cause of a deformity, all he was concerned about was its correction. Such ideas are contrary to good teaching. In proportion as the normal condition is understood, so will the abnormal be recognized and in proportion as the cause of the abnormal is understood so will the treatment be successful, and normal occlusion obtained. The correct principles underlying the extraction of teeth cannot be understood unless there is a thorough comprehension of the normal physiognomy, normal antagonism of the teeth and what forces and conditions cause a normal development, and what forces an abnormal development. The teacher of orthodontia who spends his time in the discussion of an appliance for every deformity and but lightly reviews the anatomy, histology, physiology and principles of applied dynamics, has missed his opportunity.

In both papers just read the taking of the first molars and the cuspids as guides has been criticised and perhaps rightly, if taken as sole guides to correct occlusion, but improperly if only taken as suggested guides. Few dentists know what tooth occludes with certain others, while if a starting point is taken as suggested by Dr. Angle, it is simplified. I have found the suggestion of great assistance in teaching, but of little value in its extreme.

In closing I desire to say that the criticism of the term occlusion, as used by some authorities, is well taken, also the criticism of "Ready to wear appliances."

Dr. H. A. Pullen, Buffalo, N. Y.

The subject of Orthodontia Technology as presented to us this evening by Dr. Case, is one of special importance to the teacher and practitioner at the present moment when the science of orthodontia is making

such rapid progress that its perspective is only visible to the few who have given it special study and along certain definite lines.

There is only one section of this paper which I am going to discuss to any extent, and that deals with the classification of irregularities, and it brings up the question as to what we shall teach as of more mometary importance than how we shall teach.

The essayist asks you to adopt his scheme of classification without question as to its comparative excellence. Would it not be wise to argue the matter pro and con before deciding this question which is one of vital importance, and which deals with the foundation principles of this science, according to our present knowledge of the same?

A few years ago, there appeared upon the orthodontia firmament a radiant star, which at first startled us by its brilliancy and grandeur, but which, as we studied and observed its splendor, gradually illuminated our horizon, and shed its beneficent rays upon a grateful science, which so developed and improved in a short time that the star was considered an absolute necessity for its existence, and further advancement.

Occlusion.

Gentlemen, that star was the theory of occlusion in all its relations to orthodontia, as discovered by Dr. E. H. Angle, and it will stand as a monument to his untiring efforts for the advancement of orthodontia for all time.

The advocates of occlusion make all their deductions from an ideal condition of normal occlusion, which condition, though a temporary one, we grant, is yet sufficiently permanent to account for the normal eruption of the permanent teeth through the influence of the inclined planes of the cusps of erupting antagonizing teeth; sufficiently permanent to account for normal interdigitation and interlocking of cusps of the permanent teeth through interdependence of the arches of teeth, sufficiently permanent to be an integral and important factor in the laws of articulation as given us by the late Dr. Bonwill, and which are now taught in every college in the land; sufficiently permanent for the unaided retention of the normal position of certain simple irregularities which have been corrected; sufficiently permanent to warrant the founding of a classification of irregularities of the teeth from the variations from this normal condition. By it diagnosis and prognosis are rendered more accurate and scientific than by any other method; yes, and our experience justifies us in granting it sufficient permanence so that restoration of these ideal conditions by proper treatment restores the ideal facial lines when faulty on account of malocclusion.

Normal occlusion is a condition of perfect relationship existing between the normally formed and aligned teeth of normal dental and alveolar arches of maxilla and mandible, when in antagonism, the mandible being in its

farthest posterior position and in perfect median register with the maxilla, and both in normal relationship with contiguous tissues.

Such a condition precludes abnormal relationship of contiguous tissues, such as over or under developed alveolar or maxillary zones, or maxillary or mandibular protrusions or retrusions, and in its most pefect conception can only be seen in a perfect anatomical subject.

The facial lines are dependent upon the normal occlusion for their normal relationship, hence, the occlusion is the factor of prime importance rather than the facial lines.

In the three-class scheme of classification, the facial lines are only symptoms of each class, being variable in the first class, and of a certain more definite and recurrent type in the second and third classes.

Shall we diagnose a case of irregularity from symptoms which disappear upon proper treatment of the occlusal relations of the teeth?

We would have it understood that normal occlusion is incompatible with any degree of irregularity, and that with this ideal relationship, normal occlusion and normal facial lines are inseparable.

In the diagnosis of any case of malocclusion, the occlusion is first noted, and then the variation of the facial lines from the normal, and in every case the variation of the facial lines from the normal is considered as caused by a variation from normal occlusion, and is, therefore, a symptom of faulty occlusion.

Classification, dependent on variation from normal occlusion, more than answers our requirements in diagnosis for the majority of cases, which are typical of the class to which they belong.

In the cases in which the essayist has extracted, I think that more ideal results could have been obtained, both as to facial contours and occlusal relations by saving all of the teeth and adjusting the occlusion to normal conditions.

Extraction.

The pictures thrown upon the screen are not convincing to my mind that a case of Class II (Angle's classification), for example, of distal occlusion of the lower arch, is not amenable to the treatment for the class, of restoration of normal occlusion, preserving, of course, the full complement of teeth, at the same time restoring normal facial lines, and using a simple appliance, the arch and clamp bands as used in the Baker anchorage.

This is in marked contradiction to the results obtained by the essayist, who has left the lower jaw in its posterior position, extracted upper bicuspids, and not improved the facial lines by the operation to the extent he might have done by more conservative treatment.

The paper presents no basic principles, from which deductions as to

diagnosis and treatment may be made. Occlusion as a basic principle has been entirely ignored.

Deductions made from any other basis than that of occlusion are unscientific and unreliable. Occlusion is the prime factor for consideration in every step in orthodontia, in etiology, diagnosis, prognosis and treatment.

In the treatment of Class II (distal occlusion), restoration of normal occlusion is usually brought about by changing the occlusal relations of all of the teeth of both arches, moving the lower teeth forward and the upper teeth backward, at the same time changing abnormally shaped arches to normal. This operation, performed either unilaterally or bilaterally, as indicated, is different from that of jumping the bite and much to be preferred.

The retrusion of the lower jaw is a type of case of very common occurrence in my practice, and I do not feel justified in simply extracting the first bicuspids and forcing the upper anterior teeth back beyond their normal position, and leaving the lower jaw in its abnormal pose.

Extraction is the exception to the rule, and seldom resorted to in the treatment of any of the three classes of malocclusion.

Classification. The classification according to occlusion has come to stay and it is only a question of time, when it will be accepted by all those who are working for the upbuilding of this benevolent science.

In answer to correspondence with the author of the theory of occlusion regarding Dr. Case's classification as proposed in the essay this evening, he has this to say: "Think of dividing malocclusion into some twenty different classes! Why classify it at all? Why not leave it in chaos? for this is not much better? And then, too, think of twenty different classes without once mentioning occlusion! How is that for a scientific classification, when we know that occlusion is not only the very basis of orthodontia, but of all dentistry, and that every operation in dentistry has a bearing on occlusion." It seems to me that Dr. Case is attempting to classify the superficial symptoms rather than the fundamentals. It is apparent that he does not understand my classification, and I am constrained to believe that he does not appreciate the simple principles of normal occlusion.

In reality it is not my classification. It is Nature's. I have simply pointed out the classes, divisions and subdivisions in which Nature arranges the teeth in malocclusion. These classes are not arbitrary nor new. They have always existed, and always will exist as long as man suffers from malocclusion, and these different classes, divisions and subdivisions

may be renamed and rearranged, but what they are called would not or could not make any difference in the actual conditions existiug.

I believe the teachers, and certainly, the students of orthodontia, who familiarize themselves with these conditions, will not only find out that it is the natural grouping, but will derive from it great comfort in the diagnosing and treatment of their cases. Since recognizing the principles in this classification of malocclusion, my own practice has been immeasurably simplified. "In art—in all things, the supreme excellence is simplicity." If anyone shall give us a better classification than the standard one now existing, no one would be more pleased nor more heartily welcome it than myself, but until that time I am quite content to leave the whole matter in the hands of the thoughtful, conscientious students of orthodontia."

Dr. Guilford's Paper.

It is very evident from the reading of Dr. Guilford's paper that he also does not consider occlusion in its proper light nor give it the importance it deserves or he would not have asked under what condition it was advisable to extract, nor would he have committed the error of extracting in some of the cases which he has shown us, where it was certainly contraindicated, according to our present knowledge of the demands of occlusion. However, there are cases in which extraction is advisable, as even an extremist will admit, but only where the demands of occlusion sanction it, where an improved rather than an ideal occlusion seems called for. Nor can a set rule for these cases which shall be inclusive of all conditions be formulated, because of such factors as the condition of the teeth themselves, peculiarities of occlusion, the temperament of the individual, etc.

I have already intimated that the occlusion was of sufficient duration to account for cusp influence in all its bearings on occlusion, and I cannot be persuaded that its influence is so momentary as to "determine nothing" as the essayist indicates.

"Relation of the teeth" is not a synonymous term, for the teeth are related in all positions of articulation, but they are not in occlusion except in one position, which I have already explained.

It is true that we have expanded the term "occlusion" to include relation as well as position of the teeth while in occlusion. A better term has not been suggested, and I believe the term "occlusion" will stand on its merits.

The essayist himself has some difficulty to dispose of the term in his paper, for he speaks of "the first molars occluding normally," where it is certain he meant the normal relationship of the teeth.

Dr. Guilford has again misunderstood the meaning of the expression

"key to occlusion," as related to the first molars. The extremists, as he calls them, mean by this that only with the first molars in normal occlusion and relation, is the normal occlusion of the other teeth possible, referring especially to the antero-posterior or mesio-distal relationship.

Again, I cannot agree with the essayist in his ideas on single tooth anchorage. In hundreds of cases in which the first molars alone were used for anchorage, no harm has as yet resulted in a single case, and although it is advisable to use re-enforced anchorage in many cases, the first or second molars or even the second bicuspid may be used for anchorage for the majority of cases, for the attachment of buccal arches.

In both of the papers presented, occlusion in its proper sense has not been recognized. Occlusion is not an impractical nor is it an inapplicable basis for its importance is understood and its benefits appreciated by a large number of thoughtful, studious and unbiased practitioners.

In my own practice of orthodontia as a specialty, occlusion is the one consideration without which I would be at sea in diagnosis and treatment, and would consider myself entirely ignorant of orthodontia as a science with a scientific base.

If occlusion were of no value, the specialist who has had practical experience with it in diagnosing and treating cases would be the first to discredit it, but those who do understand the theory and practice of orthodontia from the basis of occlusion have nothing but praise and commendation for it, recognizing that the science has been placed upon a higher plane than ever before through its use, and that the benefits to humanity have been multiplied manifold.

Is it wise to leave it out of the college teaching?

In this discussion, I realize my inability to more than state the advantages to be derived from the adoption of occlusion as to the basis of the science of orthodontia.

The preponderance of evidence in favor of the theory as the chief consideration in the management of any case of malocclusion, must lie in the results obtained through its use, and I can only recommend to your observation and criticism, the esthetic results in restoration of normal occlusion and normal facial lines obtained by the earnest advocates of occlusion, as their clinics and practical work along this line shall be brought to your attention, in your societies or in the columns of the dental journals.

Dr. R. H. Hofheinz, Rochester, N. Y.

The question of nomenclature reminds me of a story told of Bismarck who said that each German ought to have his own king. After listening to the discussion I feel that each dentist ought to have his own nomenclature.

I do not agree with Dr. Webster in regard to the lack of principles

in orthodontia. He said that we do not understand principles as yet; that usually we are discussing methods. It seems to me, however, that we understand the principles pretty well, but that there is a great discrepancy as to the methods to be used. I think that we understand the question of occlusion; the pathologic changes that take place in the peridental membrane; and also the teeth in malocclusion. What interests me is this: Dr. Case remarked that there are fifteen different methods by which you can rotate teeth. Now, which of these many methods would Dr. Case teach his students in the orthodontia department? Is it advisable to teach them the general technique, or is it better to give them a special method? It is unfortunate that we have not with us to-night more men who advocate different methods. In this particular field we have the method of Case, Jackson, Angle and others. Would it be advisable to chose one method for teaching, or would it be better to teach a general method embodying the principles of treatment for these conditions?

In connection with the question of a four years' course—if there is any one department in the college that requires more time for teaching than is given to it to-day, it is the department of orthodontia. Whilst it is possible to teach the students the proper technique of making an apparatus in a short time, yet the philosophy of orthodontia can only be taught after a thorough understanding of the anatomical relations and of the scientific side of dentistry. And that should be taken up in the fourth year of the course.

Dr. J. B. Littig, New York City.

My method of teaching this subject includes the projection upon the screen of the methods of each individual who has had success in regulating teeth, as far as I am able to obtain diagrams. I then criticise each and show how an operation may be done by other methods. I go through the whole series of irregularities, giving the cause of each as I understand it. It is very difficult to say just what is the etiology in many of these conditions, and I doubt whether anyone does fully understand it. We have classifications which do, in a measure, comprehend what we should present to the students.

It is very difficult to illustrate all these methods on practical cases because the student to whom a case is assigned, may graduate before his work is completed or the patient grows tired of coming to the infirmary and drifts away, so that the student may not get the full benefit of his work. Therefore, the best way is to do the practical work as simply and as quickly as possible, and we must be governed in our teaching accordingly. I tell my students what I would do if I had a certain case in my office, but under the circumstances, when we do not know how long patients will submit to treatment, it is better to do something that will

correct the trouble as quickly as possible in order that they can be discharged promptly.

Sometimes, in our own practices, we have to depend upon the character and appreciation of the patient. I am reminded very much in this connection of a maid that was sent to me by a patient with the request that my assistant clean her teeth; my assistant happened to be busy and I free and I said I would attend her myself. I cleaned them and put them in good order; but imagine my surprise when upon examining her teeth in the mirror, she said: "But, you have made them look like false teeth." A similar lack of appreciation is just what we have to contend with in orthodontia. In some cases we can regulate without extracting, taking from eighteen months to two years for the work, whereas in others we must extract so that the work may be completed in a very short time.

Dr. R. S. Hoff, Ann Arbor, Mich. All that has been presented to us has been very good. This is the first time that I have heard Dr. Case make a classification of his work, but I am not prepared to sanction it, because I do not understand it. He passed over his models and appliances too rapidly.

This question of teaching technique is one that we ought not to overlook. Possibly we have been teaching too much technique. Some of us confine the technique to one system, while others spread it out over every system. In my opinion none of these methods is ideal, but a certain amount of that work must be done because of its value in teaching and developing manual dexterity. As to what shall be presented by the lecture method, and how, that is a matter each teacher will have to decide for himself. I like the Angle system and classification. It is simple, easily understood and definite. Students comprehend it quickly and they can utilize it, and for that reason it commends itself.

There is another method of teaching this subject that has not been mentioned, and that is the orthodontia clinic. There is nothing that will drive home the lessons of orthodontia so profoundly as a clinic. I do not mean that the teacher should do the work for the patient, but that the students, under the teacher's supervision, should do the work and carry the case to its completion. In this way students will learn the principles of orthodontia very much better than they can from the technique course, or from demonstration on models and appliances, or a didactic course.

Dr. Ellison Hillyer, Brooklyn, N. Y. I hope Dr. Case will answer all the questions that Dr. Hofheinz asked. There are different methods of performing operations, and it seems impossible to teach the various technique in every case. I would like to know how Dr. Case would unify all methods and merge into one general system for student instruction, and whether he would have such

instruction carried out on a line with the recitation from the textbook *at the same time.*

Dr. Case. Occlusion.

My classification met with about the reception that I looked for from the adherents of the three class scheme. One would judge from Dr. Pullen's remarks that I had attacked the great principles of occlusion and their importance as a factor in the correction of irregularities of the teeth. Nothing was further from my intentions as my paper will show. The reference that it makes to occlusion is to show that it cannot be used as a basis or guide for determining the character of an irregularity, nor in any sense to indicate the treatment that should be used for its correction. And I think that I have proven conclusively, by the illustrations I presented, that this is a fact.

In the correcting of all irregularities of the teeth with the view to their permanent retention, occlusion is one of the most important factors for consideration in diagnosis and prognosis.

In every case where the masticating teeth have established a fixed occluding position with cusps that interlock or interdigitate, whether it be typically normal in its relations or not, any change of that position necessary for the accomplishment of correction should place them in a new occlusal position of self-fixation, else nature, either in her forceful efforts to perfect the function of mastication, or in response to the law of inheritance, will mar or wholly destroy the perfect results of treatment, even though they be artificially retained for years.

In cases where one or more teeth of either jaw are crowded out of the arch alignment, or are abnormally turned and overlapping, if held in that position by the fixed occlusion of other teeth, any movement to accommodate them that is destined to affect the relative positions of the bicuspids or molars will usually require a concomitant movement of the occluding teeth of the opposite jaw.

In a large proportion of cases, and especially those which appear in the simple and complex groups, the relative size and general relation of the jaw bones are in perfect harmony with the stage of their development, or sufficiently so to make the rule imperative, that we strive to produce a typically normal occlusion—an attainment that is impossible where teeth are extracted merely to simplify the operation, or under a mistaken impression that regulation cannot otherwise be accomplished.

Extraction.

This does not mean that the principal and only object in practice is to attain to the production of a typically normal occlusion at the expense of producing or retaining a facial deformity; and especially when by the extraction

of the first or second bicuspids we can place the operation within sure and easy possibilities of correcting the facial deformity, and leave the patient with a good masticating occlusion—often so perfect that only an expert is able to discover that teeth are missing.

In the contemplation of obtaining room for the correction of malposed teeth, or for the freer eruption of the permanent teeth, by the expansion of an immature arch or by the extraction of the temporary or permanent teeth, the harmonizing influences of growth with the natural enlargement of the alveolar arches should never be lost sight of. If dentists would give more thought to this subject and to the possibilities of judiciously enlarging the arches in keeping with the present and future development of other parts, there would not be that ruthless and uncalled for interference and that wholesale malpractice of extraction that now disgraces the science of Orthopedic Dentistry.

With modern methods and principles of applying force to the teeth, the dental arches can always be sufficiently and harmoniously enlarged—at both the occlusal and apical zones if required—to place malposed ones in perfect alignment. Therefore that phase of the question should never arise as an obstruction to correction without extraction. But the principal question which should be considered under these circumstances is: Does the present condition, or will the future development, of facial contours demand or permit, such an expansion, with a concomitant movement of opposing teeth, if necessary, to perfect the final occlusion.

In the old methods of enlarging the dental arch with plates, etc., and even with some modern appliances, the arches were always expanded laterally with little or no thought to the possibilities of the far more important distal movement of the bicuspids and molars, which is frequently demanded to restore them to the position from which they may have drifted and which nature intended they should occupy, to prevent the front teeth from being proportionately protruded.

It, however, is not advisable, after the erupting of the second molars, to attempt an extensive distal movement of back teeth that have not been moved forward by natural or artificial forces. Nor is it advisable to laterally expand arches to a width that is more than relatively normal, with the frequent production of an unnatural exposure of back teeth at every movement of the risorius muscles, that are sometimes seen from the hands of dentists who believe that extraction is never demanded nor required. To assert this, is to deny the influences of admixture of the types of different nations and races, which, through the laws of inheritance and variation, have produced the great variety of physical forms that especially are found in America where these causes have had full sway.

Classification. In regard to my classification, I can see no objection—in fact only good—in dividing irregularities of the teeth into as many classes as there are distinctive recurring irregularities that differ in their principal characteristics and demands of treatment from other recurring irregularities.

This question must surely resolve itself and be guided to its solution by actual conditions that we meet. If these actual conditions become familiar as distinct varieties of irregularities which differ from each other both as to character of inharmony that they produce, and the treatment demanded for their correction, it must certainly constitute a class according to every scientific law of classification. When dentists are able to recognize these different distinct varieties by the special inharmony or deformity which they produce, and when we are able to instill them into the minds of our students, they will then—and not till then—be able to outline and follow the proper course of treatment which the case demands for its most perfect correction.

Dr. Guilford. I think what Dr. Hofheinz meant to ask was, whether in teaching orthodontia we taught the different methods advocated by different men. For myself I can answer. We have had many systems that have become so entirely obsolete that they are matters of history only, although some of them possessed certain virtues, and in my teaching I always refer to this fact.

With regard to the appliances: If a student knows how to draw a wire, how to make tubing and how to make a nut, he has all the requirements that he needs if he knows what he wants to construct. Those are the fundamental things he must know. He must also know what to do in certain cases, and to learn this he must have, in addition to the didactic teaching, clinical instruction. Students bring me cases for examination, and I have them make models and present them to me. That gives them practice in making models. Then I look over the model with them and ask what they would do in that particular case. After I have their opinion I tell them that this requires work of a certain character which can be done in this way or that way or some other way. Now, what plan shall we pursue? I discuss the various methods that I have outlined, stating the advantages and disadvantages of each, until I finally decide on what ought to be done. Then I tell them to go ahead, make the appliances and treat that particular case. I do not think that much stress should be laid on the teaching of systems because the tools and appliances we use are as old as the hills and do not belong to anyone. They are the foundation of the devices which we wish to construct, and if the student knows how to make them, and what course of treatment to pursue, there ought to be no very great difficulty about the matter.

Methods of Teaching the Anatomical Arrangement of the Teeth.

By B. J. Cigrand, M.S., D.D.S.

This is an age of the practical, and the trend of the times is towards the serviceable and comfortable. Theory and speculation are necessary attributes to progress, but the basic element always remains centered in the practical.

The ancient Spartan king, Agesilaus, when asked what things boys should learn, replied: "Those things which they will practice when they become men." This remark expresses a truth which is as forceful today as at any time of the world's history; in fact, in these days when labor-saving devices and time-saving ideas shape the destinies of individuals, the practical becomes a most potent factor.

Prosthetic dentistry, like any of the other arts or sciences which has a sub-structure—mechanics—advances in theory only, when that theory bears successful results in practice. In its two-fold evolution it absorbs from every available source which tends to broaden its art or perfect its science, in consequence of which, it calls to its aid, all the kindred professions.

The Mechanics of Mastication.

The study of mastication is one which is of greatest possible concern to both the operative and prosthetic dentist, since assurance of success is only possible when a complete mastery of the subject of mastication is reached, and this happy era has not yet arrived.

Of course we owe the inceptive thought of perfect artificial mastication to Dr. Bonwill, of Philadelphia, though he was much in error as regards many of the masticatory principles; still in a number of important points he was correct, and he deserves much credit for having directed our attention to the careless and non-anatomical manner in which the artificial dentures were being constructed. Notwithstanding the fact that close observation demonstrates that his theories on crucial points was incorrect, we must remember him as the great advocate of normal masticatory arrangement.

It would be of great interest to recite the progress that anatomists have made in their study of the mechanism of mastication, but sufficient is the statement that for two hundred years the medical and dental practitioners have been struggling with the problem and are gradually conceiving the principles which govern this divine ordination.

Artificial dentures as generally constructed are decidedly abortive and do not thoroughly fulfill the purpose for which they are intended, and the time is coming when the old-time ginglymoid articulator will claim the same consideration in prosthetics that the turnkey holds in oral surgery. It will be a thing of the past and serve simply as a milestone in the evolution of dentistry.

There can be little doubt as regards the inefficiency of the artificial denture which admits of only ginglymoid movement, since this mere hinge movement is not in accord with nature. Disregard for normal or perfect mastication has led the practitioners to grow indifferent to nature, and the result is that the public pays the penalty of violation of nature's laws.

Many practitioners offer as an argument that the patients do not appreciate the true worth of teeth constructed to allow accurate jaw movements; besides the same dentists claim the time devoted to so laborious a task is not sufficiently compensated. To the first objection I would say, if the dentist will instruct his patients in the science of normal mastication, incidentally pointing out the value of lateral movement, the patient will ardently accept his judgment as deserving recognition.

The Articulator.

Those who anticipate an instrument in the form of an articulator which will make occlusion and articulation in artificial substitutes positive and certain in every case are certainly harboring in their minds a delusion. Our professional work is such that, no matter how carefully we mount our artificial dentures, we must always construct trial plates, make changes and even after the case is soldered or vulcanized we must carve and alter the occlusal surfaces until in the mouth we get perfect results. This art side of dentistry can never be eliminated. It stamps us as something more than mechanics, in that we cannot always follow set rules or depend on the

machine production. The articulator holds the same relation to dentistry that the pentograph does to the artist—serving simply to register basic lines—it then remains for the artist-dentist to incorporate ***detail, minutiae*** and ***life.***

There is not so pronounced a lateral movement in the jaw in mastication as previous writers have depicted. During normal mastication the lateral motion of the jaw is slight, seldom exceeding one-third of the width of the occlusal surface of the first superior bicuspid.

The reason why anatomists in the past have failed in their registry of the movements of the jaw can be traced directly to the dissecting rooms, where they have prosecuted their search for knowledge on the cold and lifeless body, instead of the living subject. Further, teachers of anatomy invariably instruct students from the skeleton, which has the lower jaw hinged at the glenoid cavity, whereas it should be pinioned at the line of occlusion, immediately below the glenoid cavity. This incorrect method of demonstrating the position of the jaw has prejudiced the minds of students and instituted a variety of misconceptions.

To Dr. Bonwill we are all indebted for much knowledge on the subject of articulation and occlusion; and I am proud that I received, some years ago, personal instruction from Dr. Bonwill regarding his methods and system of arranging artificial teeth. Though I do not now agree with him in most particulars, I nevertheless revere him for having directed my attention to this, the most complex problem in dental prosthesis.

Before proceeding with the scientific results, as I have found them, I wish to call attention to the fact that the paper is intended primarily to prove that the ordinary articulator, which allows simply a ginglymoid movement, does not admit of reproducing nature.

Value of Illustrations.

To facilitate instruction to students, diagrams are employed as they assist in simplifying the explanations, and aid the mind in retaining outlines and devices. The importance of illustrations cannot be overestimated if it be true, as psychologists say, that fully eighty per cent. of human intelligence is obtained through the optic nerve. They are most essential when it is the purpose to elucidate facts relative to material things; illustrations admit of abridging the reading matter, and in this age of rapid thought they aid the power of both preception and conception. There are teachers who share in the belief that pictures detract from the truly scientific and there are leading educators who never "resort to any diagrams," since they say they are capable of giving perfect word pictures. This may have been the thought in the days of Addison and Steele, but in these time-saving days, instead of wasting four pages de-

scribing the lady's hat one-tenth page will portray the headgear and the wearer.

Illustrations serve to abbreviate the subject matter and aid in accurately registering the object in the memory. In fact, in all works which deal with material things, and more especially with mechanics and its varied devices, illustrations are indispensable. To impress this study more fully I request the student to reproduce the diagrams, designing from nature—not from Gray's Anatomy, which is faulty in its odontography.

There is nothing that sharpens the judgment so much as drawing; there is nothing I know of that gives a keener insight into objects and

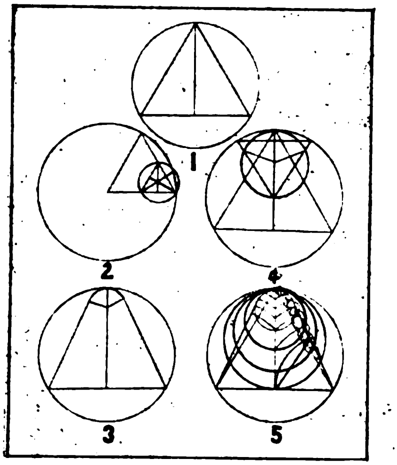

Diagram A.

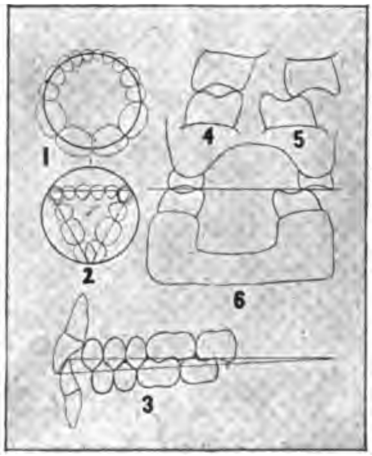

Diagram B.

the nature of their imperfections, their ups and downs, their smooth or irregular surfaces, than drawing. The character of the object makes a profound impression upon the brain, in that you must educate the judgment to see and follow the line and carve the outline on paper of the image that you have before you. This calls for your undivided attention and stamps the model indelibly upon the brain.

The necessity for manual training and keener digital dexterity must appeal to all who are familiar with the student career. Men who have acquired a knowledge of drawing and who have given some attention to sketch work readily comprehend the delicate outlines of the teeth. Their judgment for accuracy has thus been sharpened. Diagram A is an accurate reproduction of Dr. Bonwill's theorem and Diagram B indicates his

methods of arranging the artificial dentures. I show these to remind you of his idea relative to articulation and occlusion; besides we can then employ them in a referential way during the discussion.

Arrangement of Teeth.

The teeth are so arranged in a dental figure that a strain which falls on any one of them of either half of the superior or inferior dental arch, is communicated to the several teeth on that side of the jaw, thus

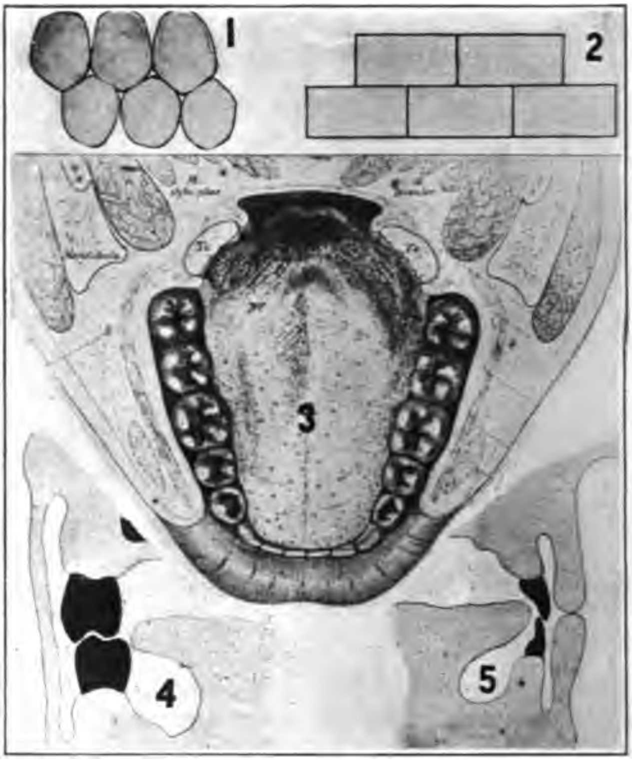

Diagram C.

distributing the strain. Hence each tooth is as independent of its neighbor in its functional character as though the masticating apparatus consisted of but a single superior and two inferior teeth, or vice versa, as Diagram C, Fig. 1, shows. This disposition of the teeth is well illustrated in architecture in the building of brick walls, and is known as "bricking the joints." Fig. 2. In the mouth this arrangement serves the dual purpose of permanently establishing the position of each tooth and assisting most decidedly in breaking food of a brittle character. Fig. 3 represents clearly

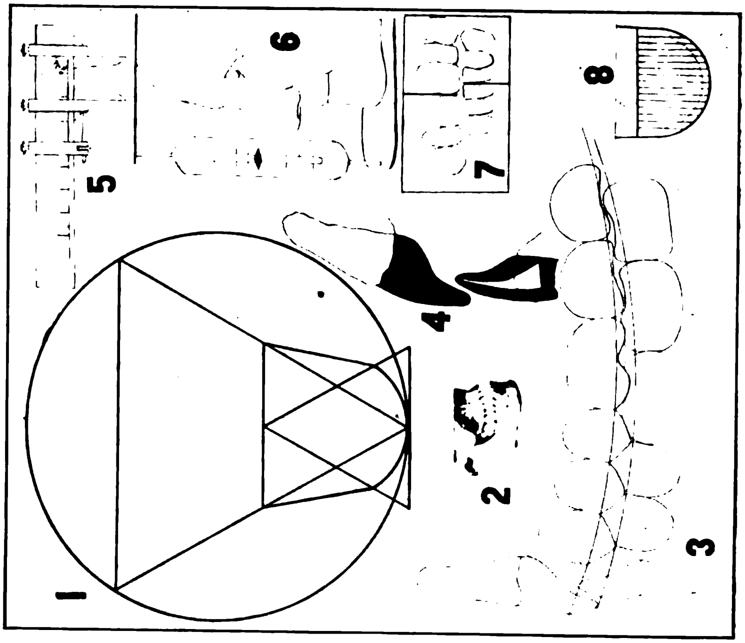

Diagram E.

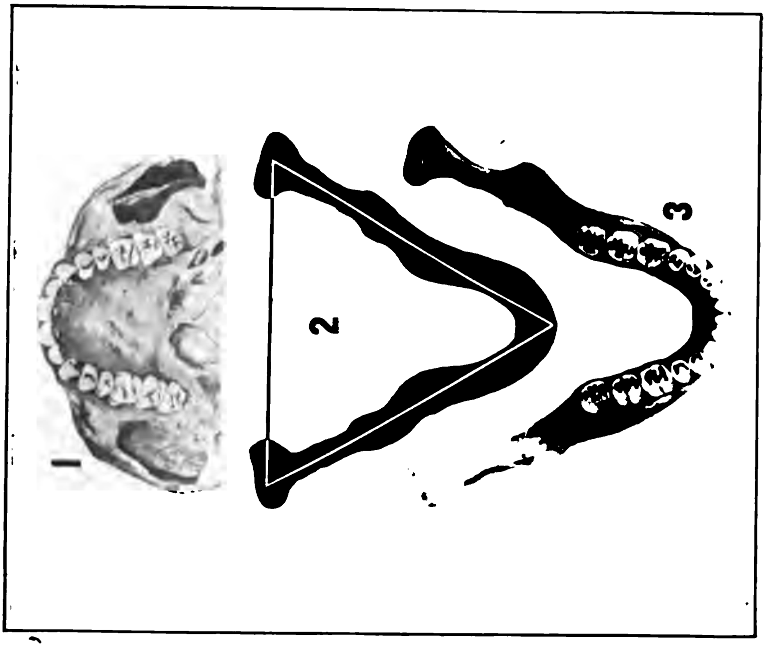

Diagram D.

the inferior half of the mouth, known as the lingual cavity, showing how the tongue hugs the surfaces of the teeth and how the lips and cheeks fold about the opposite surfaces. A wise arrangement in nature admits that mastication can be vigorously prosecuted without molestation of the tongue or cheeks. This happy result is attained in that the inferior teeth extend to the center of the dental figure, while the superior teeth extend to the circumference, as shown in Figs. 4 and 5. Artificial teeth should be ground to yield occlusal surfaces and so shaped that the superior accurately complement the inferior teeth, Figs. 4 and 5. If constructed thus they will glide over each other more readily, facilitating mastication and assisting in retaining the dental bases. I cannot agree with the theory of Dr. Bonwill in his dental forms. He has the lingual cusps of the inferior teeth too high, and they pitch too decidedly outward above and inward below. Such a condition will tend to dislodge the superior base.

Diagram D. This accurately represents the figure which the teeth form in both the superior and inferior maxillary bones. I labored diligently to portray the two jaws in harmony with nature, and have brought innumerable models, casts and skulls to aid in demonstrating that the drawings are perfect. Upon this diagram I base my theorem of trigonometry, relative to the disposition of the teeth, and of which I will speak later. Fig. 1 indicates the superior maxillary bone and Fig. 3 the inferior, while Fig. 2 gives us a shadow or silhouette view. The triangularity of the lower jaw immediately appeals to us; hence, if a line is drawn from the center of the right condyle to the same point on the left, and then two lines from these points that will meet at the septum of the inferior incisors, there will have been described a perfect equilateral triangle. Fig. 2. You will observe that the human jaws are not so pointed as indicated by both the drawings and theorems of Dr. Bonwill. They are not so short and sharp as he represented them. And if he portrayed the shapes of the jaws contrary to nature, he also applied the wrong theorem and could not hope to attain the normal philosophy of these jaws. I am satisfied that he was in error in his geometric deductions, and although he was a close student of this subject, I fear he failed to select the composite jaw, and in consequence did not complement the right geometric figure; besides he advocated that his theory applied to all jaws and was too positive of his measurements.

Diagram E. In this I have designed the theorem which meets the general requirements of the proposition under consideration. In the first place, we use a circle to facilitate getting a perfect equilateral triangle, since geometry teaches us that a perfect equilateral triangle is produced by joining three lines of equal length within a circle. I next observed that in the anterior portion of half of the triangle the teeth were located:

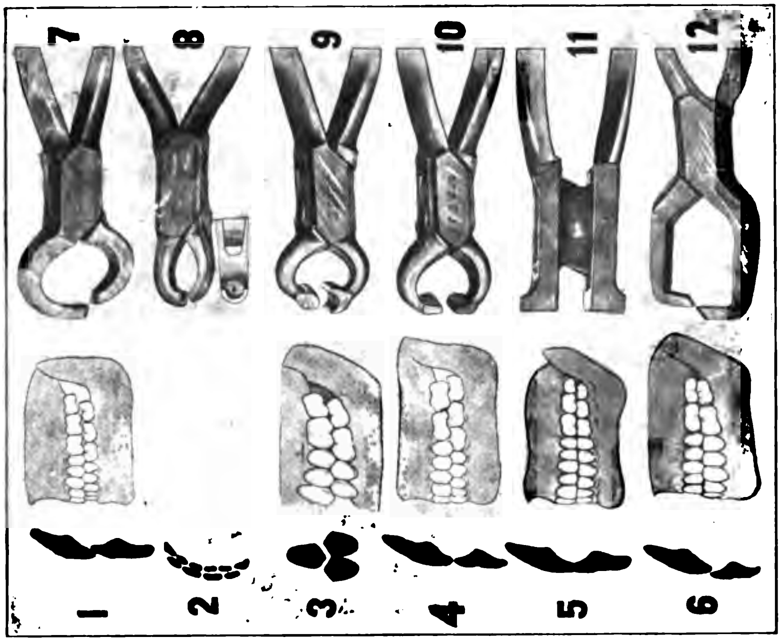

Diagram G.

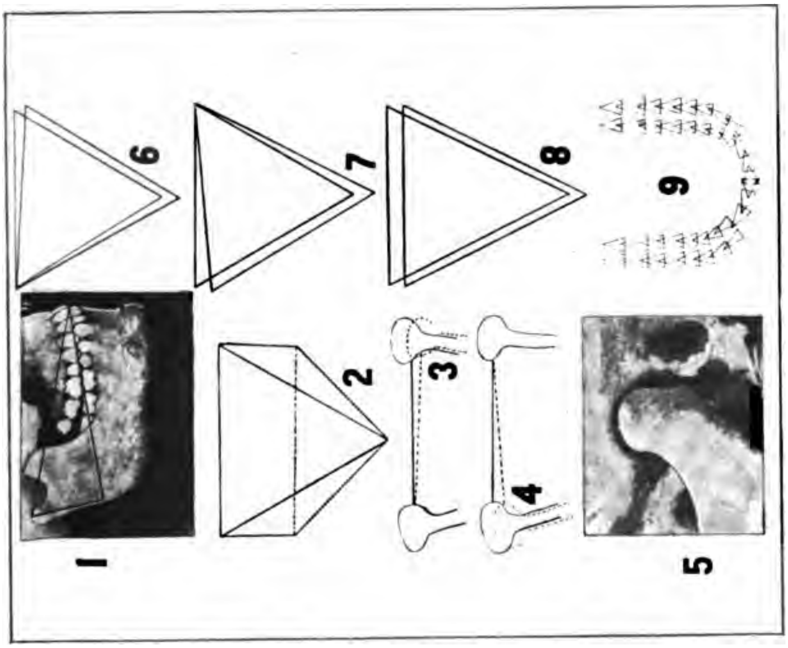

Diagram F.

that the base of this sub-triangle marked the position of the molar teeth. Geometry teaches further, that when two equilateral triangles are brought in opposition with their cones, they form the outer surfaces of a squaic, the center of which describes the arc of a circle. Where the circle meets with the straight line is registered the first inferior bicuspid. It has been taught in the past that the cuspids were the prominent teeth which marked the point where the circle verged into a line, and consequently we have been at loss to ascertain the geometric figure and proposition. This would answer our purpose. The first bicuspids in the inferior maxilla are the guiding points and their importance must not be underestimated, as I will shortly demonstrate.

Dr. Bonwill was working along the right lines, but accepted the wrong theorem, and consequently his jaw is too pointed and does not fulfill the requirements of nature. You will notice that this vexed query is simplified by my figure in that we dispense with the innumerable lines, circles and fractional circumferences found in Dr. Bonwill's theorem. The question is not one of circles, but of triangles, and the next few figures and diagrams will prove that triangles are the fundamentals.

Fig. 2 gives a clear idea of the curve which is found when viewing the jaws from the lateral aspect. Dr. Bonwill taught us that the length of the cusps diminish as we go distally. This was indeed a great discovery and I need not dwell on the importance of understanding the purpose of this curve and the necessity of knowing the value of Dr. Bonwill's deductions in their relation, for all present must be familiar with this, the crowning glory of that great man's life. I might add that he represents this overbite as a triangle, Diagram B, Fig. 3, and I have drawn it to approximate nature and represent it as two curves approaching each other distally.

The lower jaw during the process of mastication forms somewhat of a triangle while opening and closing, as Fig. 4 indicates. When the jaw is opened it falls backward and downward, and in closing it moves slightly forward and then upward, describing the outlines of the figure represented in Fig. 4. Now, if the anterior tooth goes through this movement and describes such a figure, all the inferior teeth, being a stable part of the jaw, must necessarily form a like figure. To determine what relation this movement has to the shape and movements of the jaw and condyles, I have had manufactured the instruments you see in Figs. 5, 6, 7 and 8, and by their use I have arrived at many interesting conclusions.

Masticating Movements.

Diagram F, Fig. 1, represents what I have chosen to call a lateral triangle, which is formed by a line from the condyle forward to the front teeth, then back over the plane of occlusion and thence up

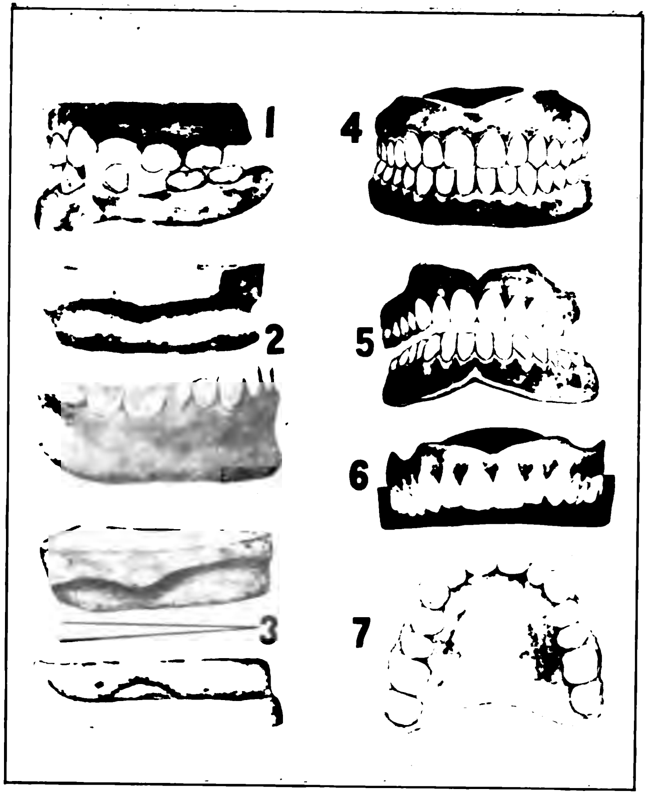

Diagram H.

Diagram I.

to the center of the condyle, and the lowest point is the pivotal point of the jaws. When this imaginary triangle is coupled with the anterior triangle they describe Fig. 2. Another set of triangles is formed while the jaw is in process of mastication. When the lower jaw rotates to the left the right condyle moves forward and downward, while the left one simply turns on its axis. The reverse is true when the jaw is thrown in the opposite direction, and in consequence imaginary triangles are formed corresponding to the depth of the glenoid fossa and the length of the cusps of the teeth. Figs. 4, 5. This assists in determining the overbite. When the jaw cannot be freely rotated it indicates a predisposition on the part of the patient to live the life of carnivora, meat-eating; while when the jaw can be readily thrown from right to left there is a disposition in the owner to be herbivorous, grain and vegetable-eating. In the former the glenoid cavity is deep and in the latter shallow. Fig. 5 illustrates the condyle *in situ*, the glenoid cavity being clearly portrayed. The condyle moves forward and downward until obstructed in its further tendency by the eminentia articularis, and when the condyle moves beyond this point there is dislocation. Fig. 6 shows the inferior jaw thrown to the right, Fig. 7, moved to the left, and Fig. 8, thrown forward. The triangle being pinioned at either right or left side, and being a perfect unit, all points must swing in the arc of the circle in proportion as they are distant from the pinion center. If this be true—and I see no error in it—then the cusps in normal mastication must all describe small triangles as Fig. 9 illustrates. Hence, everything seems to indicate that the philosophy of mastication is founded on triangles and not on circles. When we more thoroughly understand these principles we can produce prosthetic substitutes capable of rendering service. If we continue to construct our dentures in defiance of these underlying truths, we are not only yielding abortive results, but are disgracing the Divinity which enters into the work of our noble calling.

Mechanical Forces in Jaw Movement.

Diagram G. I here outline what I think indicates the various mechanical forces which the jaw can employ. Figs. 1 and 7 represent the mechanical force of the front teeth in normal mouths. Figs. 2 and 8 show how the jaws meet simultaneously in cutting. Figs. 3 and 9 demonstrate the force, as applied at the juncture of the superior bicuspid. Figs. 4 and 10 illustrate the force when the front teeth meet directly on the incisal edge. Figs. 5 and 11 indicate the open and shut movements, as in the parallel-pliers. Figs. 6 and 12 show the mechanical apparatus in cases where there is protrusion of the inferior jaw.

Diagram J.

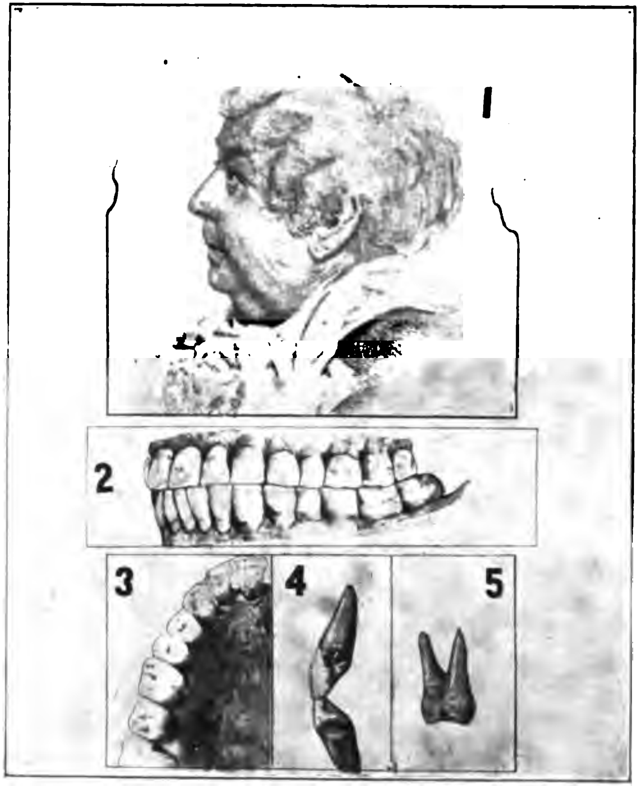

Diagram K.

Problems in Articulation.

We all recognize that in cases of dual bridges, as indicated in Diagram H, Fig. 1, with the ordinary open-and-shut articulator we often produce a splendid case, yet when we attach it in the mouth it requires considerable changing—necessitating the grinding off of porcelain facings and gold cusps, whereas, if we possess an articulator which mimics the jaw, the teeth can all be carefully adjusted before attaching them.

Diagram H. I here present the variety of problems which confront us on the subject of the position of the artificial substitutes. Fig. 1 indicates how imperative it is to be prepared to have our dual bridges constructed to receive the variety of forces of the jaw. Fig. 2. portrays the making of an upper denture when the lower teeth are still in position, thus indicating the curve of occlusion. But Fig. 3 illustrates the difficulty in determining the exact position of this curve. We are at a loss as to whether it shall take an upward or downward tendency, yet on this particular operation depends largely the practicability of the case. I have not been able to solve the problem, though I am of the opinion that the curve should in most cases take an upward tendency, but this would be more easily determined by a careful study of temperaments. Fig. 4 shows how the artificial teeth should be ground, giving a rather pointed and ridge-like tusk. This I contend must be done for two reasons; first, it admits of natural relation of the jaws, and second, the cusps must be so formed as to readily incise, tear and grind the food, since the artificial denture is less stable than the natural one, and the teeth must cut the food with less strain.

The artificial dentures which I exhibit (vide H. 4, 5, 6 and 7), to this society were constructed from six sets of teeth. From these several sets I selected such sizes as approached nature and then ground and shaped them so they would admit of lateral movement, thus mimicking nature.*

A Study of Faces.

Diagram I. This I designed to show the three classes of faces. Fig. 1, the normal skull; Fig. 2, the straight face, represented by Daniel Webster; Fig. 3, the concave face, showing Cardinal Newman, and Fig. 4, the convex face, portraying Henry Clay.

Diagram J, Fig. 1. These variations and the temperament as indicated by Susan B. Anthony, and her constitutional outlines show us that her teeth are well developed and have clearly defined cusps, consequently also a well-rounded curved occlusal plane, as Figs. 2, 3 and 4 illustrate.

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* These specimens are mounted on the Kerr articulator, which is constructed on lines suggested in a paper I read before the Illinois State Dental Society, at Rockford, Ill., May, 1901.

The articulator must be so arranged as to allow for the compensating curve.

Diagram K. This illustrates the opposite kind of face, and is of the lymphatic temperament. The teeth show that the jaw freely rotates. The cusps are illy defined, the glenoid cavities shallow, and there is no compensating curve. The face illustrates that of Elizabeth Cady Stanton. In such cases as hers the denture must be constructed to bear out the normal conditions of rotation.

We of to-day believe in realism. We love and adore the real, and those of us who worship at the shrine of nature reverence the divinely created. The awkward statue resulting from ignorance of anatomical outlines will soon be a thing of the past.

Methods of Teaching the Artistic Elements of Prosthetic Dentistry.

By A. O. Hunt, Omaha, Neb.

In consenting to present this subject before this body, I fully expected to put it in the form of a paper.

After beginning work upon it, I found I could not do so with any satisfaction to myself and without considerable expense to the association, which I felt was hardly warranted. I follow methods in teaching this subject that requires the constant use of the blackboard.

The endeavor will be to give you all that is possible of what occupies the time of three full sessions in the short space of time allowed here.

Prosthesis is the restoration of a part, and there is little we do that does not come under this definition.

My experience is that in order to have the student comprehend the art features in dentistry, it is necessary to begin teaching it as soon as he enters upon his course.

The best results can be obtained by associating the artistic with the mechanical as we proceed rather than to make this a special subject except, perhaps, in the senior year.

Time will not be spent upon preliminaries further than to differentiate

between ideal art and art as we can apply it in an every day dental practice. There are few Apollo Belvideres that come to us for dentures.

The variations in faces are so marked and constant that it is not possible to say that what will be suitable for one will answer for another. Each individual case must be studied, yet there are certain conditions that are common to all faces and mouths, which must be carefully pointed out in teaching.

We cannot, like the artist and sculptor, take the canvas or lump of clay and fashion the human body to an ideal; but are compelled to deal with it as we find it, and endeavor to meet the conditions that are presented, and if possible improve them.

The proper classication of this subject should be art-anatomy, as the two are inseparable. In teaching the artistic, the anatomical will always be the foundation.

In the freshman year but little can be done, but that little should be carefully taught in order to establish habits of close observation, and to become familiar with the artistic and mechanical and to be able to discriminate between them and their application to dentistry.

Models.

The student is required to make two sets of models of the upper and lower jaw of his own mouth or his neighbor's.

One made from a modeling compound impression and one from a plaster of paris impression. The modeling compound being completed first, any faults that may be present, that are due solely to the material used, are allowed to stand, until the models from the plaster impression are completed.

These latter should be as perfect as many trials and experiences can make them. The faults are not many finally. Now the two sets of models are compared.

Such things as are common to all teeth are pointed out, the constriction of the teeth at the cervical, the tuberosity at the middle third, the gradual drawing in of the tooth at the occlusal portion, the differences between the arches of the teeth at the cervical, middle third and occlusal margin. Again the universal inclination backward of all teeth. The line of occlusion which is well defined in all mouths only varying in degree, whether there are irregularities or not. The manner in which teeth articulate with each other. The relative size of the teeth as compared with each other. The central incisors with the laterals, the cuspids with the centrals, the cuspids with the bicuspids, the central incisors as to width with bicuspids and molars.

Again the relation of the teeth to each other, and particularly the

position of the cuspid teeth, as later on is shown the paramount importance of this arrangement of teeth, and the control of facial expression.

After this the student begins on the first set of models made from the modeling compound to correct the faults plainly in evidence.

When they come to the time of arranging a set of teeth, these models are again brought into requisition, and they imitate what is present in the models.

Each student then compares his own models with those made by other students, and is required to note the variations that exist, always looking for the common characteristics that are present in all.

Teaching Art.

In the junior year, the artistic based upon the anatomy of the parts concerned is taken up in detail. With blackboard diagrams and sketches the study of the muscles of expression is commenced, their origin and insertion and the anatomical relation of each one to each tooth. The function of each in its relation to the teeth, and the relation of the teeth to the lips and face.

The cuspids receive very careful attention, as they control by their position and form, all the movements of the muscles of expression of the lower fourth of the face.

In their development these teeth start from under the alae of the nose, coming into their position guided by the levator alae-que-nasi on one side and the levator labii on the other.

When in position the *cusps* of the cuspids are directly underneath in a line perpendicular with the outer alae of the nose. The fibres of the orbicularis oris with the fibres of the other muscles entering this region, draw over the canine eminence much as a rope runs through a pulley-block thus controlling to a large extent the expression of the face.

When on the subject of impressions the importance of restoring the buccinators, orbicularis anguli oris and other muscles to their normal position is dwelt upon particularly, as in no other way can a failure to do this at this time be corrected in later procedures.

Taking the Bite.

In taking the *bite* the method pursued is essentially the same as published by Dr. Molyneaux in Essig's *Prosthetic Dentistry* as a basal plan. The methods are somewhat different as more landmarks are obtained than there presented.

With the wax form in position the expression of the face is first considered.

To reach the proper results the relation of the teeth to the lips and face are first considered, as their position is important in this respect.

We begin, as Nature does, to first locate the inferior incisor teeth as to length, which is always the length of the lower lip, found by passing an in-

strument between the lines at right angles to the plane of the lower fourth of the face.

Next the contour of the wax is shaped to correspond to the labial and buccal alignment of the teeth both upper and lower, the upper protruding to equal the overbite of the upper teeth.

Should the commisure of the mouth be crooked, by additions of wax above or below this may be corrected. When the place of union betwen the mucous and cutaneous portions of the upper and lower lips are directly over each other in the plane of the face the position of the jaws and lips are correct.

The occlusal margins of the central incisors (the wax) should lightly touch the inner edge of the lower lip.

The cusps of the cuspids lie directly underneath the outer alae of the nose.

The median line (a very uncertain one) should be carefully noted. The high and low lip line.

The free and unobstructed movement of the anguli oris muscles over the wax to allow the mouth to open to its fullest extent to prevent the too great prominence of the bicuspid teeth.

These landmarks should be carefully and accuraely made. When placing in the articulators all should be preserved and retained by gauge, or otherwise, until the time of removal from the articulator.

Many things are passed by because of their mechanical nature and belong to the subject but time will not allow of their consideration.

Next is considered the artistic selection of teeth according to temperament. In this year only the fundamental ideas of temperament are taught as they apply to the teeth alone, reserving for the senior year a full and elaborate discussion of this subject.

The type, color, size, etc., of the teeth of each basal temperment is thoroughly impressed upon the student at this time; more would be confusing.

With the landmarks already obtained the Bonwill system of the grinding and arrangement of the teeth is made to conform, in this way combining the best in mechanics and art.

The final shaping or finishing of dentures is especially considered for the purpose of keeping the muscles in their normal position, preventing their action from displacing a denture, and utilizing the buccinators and orbicularis oris from retention. Last but not least the shaping of the canine eminence for the movement of the muscles freely and normally over them.

In the senior year a review is gone over of the artistic principles and their practical application.

These principles are verified by casts of many faces and models of the teeth accompanying each, made from living subjects showing normal conditions and others showing the variations which are constant that are neither deformities nor irregularities.

These casts are also used to show how these variations may be modified to approach more nearly the ideal.

Temperment is now fully considered and models of heads indicating the types and combination of types.

Selection of teeth noting the varying shades of teeth as observed in natural teeth according to Dr. Royce.

All this is applied to the making of practical dentures with notes on such changes as may be made and the reasons therefor.

I have made use of the lantern and chart to illustrate this subject. They did not fill the requirement entirely as many times in addition to these accessories I am compelled to fill a large blackboard with sketches and supplementary drawings.

Discussion on Papers of Drs. Cigrand and Hunt.

Dr. F. H. Berry, Milwaukee, Wis.

I undertake the discussion of these papers from the standpoint of the teacher. In connection with Dr. Cigrand's paper, is he teaching the teacher the when, where and how to teach? Dr. Hunt has told us much about the when, where and how, but I think you will all agree with me that there was very little of this in Dr. Cigrand's paper. By the "when" I mean freshman, junior or senior. By the "where," the laboratory, lecture room or infirmary. If a man is capable of holding the position of teacher of prosthetic dentistry, he should not come here to learn *what* to teach. The question is how, when and where will we teach it. We all know what to teach. Dr. Cigrand in the course of his remarks considered the usefulness of articulators. Is this the place to discuss that matter? I think that should be taken before a State society meeting and not a society of teachers.

I believe that the operative men know better the how, when and where than the prosthetic men do. They teach first dental anatomy; then operative technique and finally teach in the infirmary demonstrating on the living subject. What does the prosthetic man do? He takes the freshman

student and teaches him how to take impressions; how to take a bite and how to make a plate; giving him Dr. Bonwill's teaching. We allow students to construct their technic work along that line. When they are seniors we teach them all about temperament, and here we undo all that we have taught by our Bonwill's diagram. In the freshman year we must point out some of the parts of the anatomy that correspond to the articulator so that they will look upon the articulator as representing natural conditions. We point out the temporal muscle, the masseter, the condyle, the sigmoid notch, the glenaid fossa and its relations to surrounding structures, building up little by little a human articulator.

Then we teach that all faces are not alike; that there is a great difference in the size of the condyles, and in the length, and shape of the sigmoid notch. Then we teach an ideal line on which to build a plate. It is a fact that temperament is in keeping with the outline of the glenoid fossa, which differs in almost every skull. Of course, the teeth that accompany them vary accordingly, and here again we dispute our ideal outline of plate. Dr. Cigrand dwelt on the importance of using the proper articulator. If we are going to teach Bonwill, why not use his diagrams? We could not tell a freshman to set an upper and lower model in the articulator, unless we have explained to him the depth and angle of the glenoid fossa for the reason that if the bows in the Bonwill articulator are closed up, we get a parallel glenoid fossa which accompanies lymphatic temperament. If we get a patient of a nervous temperament then we make the casts a little thicker and throw the bows further apart. Then we get a deepening of the glenoid fossa, represented in the action of the Bonwill articulator. It makes little difference where the hinge of the articulator is because the moment the teeth separate the occlusion is broken; aim to get the bite correct and it does not matter where the circle described by the opening of the articulator is struck. Get the bite of correct length and set up the teeth natural distance apart of the jaws, and you do not need to worry about the circle of the hinge of the articulator, it would be the same at occlusion no matter what the diameter may be. We have no system and do not know where to begin nor end the teaching of prosthetic dentistry. There is no outline by means of which we can get the thing into the minds of our students. If we want to make the teeth longer than the bite, that is to open the bite, then the circle makes some difference; but as soon as we begin to meddle with the bite and change its length in the articulator then it is guesswork.

Dr. Hunt showed us that the lines of the face and of the teeth are in keeping. Where are we going to teach that? I think to the freshman, because when they get to be juniors and are setting up teeth in specimen

cases they need that. My idea is to teach freshmen anatomy, along the artistic line, and temperament or its equal. Then, in the junior year, give them photographs as near as we can to the four basal temperaments and allow them to set up teeth along these lines to suit the photograph. In that way you instil into their minds the fact that they are working after nature; whereas, in the other way they work after mathematical drawings, and when they get to be seniors they know nothing of temperament or facial lines. Dr. Angle has drawn a facial line striking the eyebrows, lobe of nose and lips. He calls this the ideal. But it is not often that we find an ideal face, because we have a mixing up of temperaments, and it is hard to get the student to recognize the different temperaments presented. It is a good thing to show him the actual face and make him recognize facial lines.

Fig. 1.

Fig. 2.

The point I want to make is that I believe it is impossible to teach students temperament. How many of you really understand the theme of temperament and can put it into use and feel sure of it? My idea is to teach a comparison of things as we find them. I want to show you my method of teaching one subject, that is that the facial outline always is the index to the shape of the central incisors. That is a good guide for the student to follow. Strange to say, our manufacturers do contrary to the study of temperament. They give us a long slim tooth and color it a dark yellow or bronze color. How often do we see such a tooth in the mouth of an individual of a nervous temperament? We must teach our students colors from another standpoint and not allow them to buy what is given

them by the manufacturer, because manufacturers construct teeth with reference only to selling them.

Draw a line across the forehead about midway between the eyebrows and the hairline (Fig. 1) Follow the chin line to the angle of the jaws on either side and upward to the first or forehead line. Cut out this diagram and you will find that it is exactly the shape of the central incisor that fits that face. (Fig. 2.) The upper third of the face has much to do with the shape of the teeth and this in turn with the expression of the face.

The place to teach that is in the junior year. Let the students compare their faces and their teeth, and when you give them a photograph all they need to do is to get the outline of the central incisor and then select the teeth that go with that temperament, and construct on lines peculiar to that class as indicated in the photograph. This should be associated with the teaching of temperament in the senior year.

Dr. N. S. Hoff, Ann Arbor, Mich.

While Drs. Cigrand and Hunt were presenting their papers the thought that impressed me more than all else was not the details of the methods they advocated in teaching their subjects, but what is the value of the presentation of this particular subject; is it not the personality of the men themselves that makes their work characteristic? Not all their ideas are new, but the method of presentation is new, and I am particularly impressed with the thought that these men must have done much original work in order to be able to present this subject as they do. What is the value of that work as compared with the more pedantic methods of presentation that we get from personal experience and from text-books? Which is the better method? The pictorial method, the didactic or the lecture method? Although I cannot take the time to discuss this phase of the subject fully, yet I will say that in my opinion both methods have value. But a good method combined with a strong personality in the teacher is worth more than any method, however good it may be.

What makes these illustrations valuable? The men who presented them thought profoundly about them! They have made them a part of their lives; they present them with enthusiasm and with a personality that claims the attention of the students. I do not think that it is always best to present them pictorially. There are other things that a man may do to claim the attention of his students; but it is the personality of the man that counts, even though he may be teaching error. If he is deeply impressed with the truthfulness of what he is teaching, his teaching must be forceful, and it will claim attention.

Dr. Cigrand is a very fluent speaker and illustrates his work in a beautiful way. Dr. Hunt is a graceful and consecutive thinker. He enthuses and charms his audience, and all that adds greatly to his influence as

a teacher. The fact that these men have worked out these things, and that they have identified themselves with them, give them power and force and enthusiasm, and this enables them to strike fire in the minds of their students, which in turn brings out the best characteristics of the teacher. Whether or not a teacher is a brilliant man in the eyes of his students is not essential; a teacher should be a man of character, for in his individuality he has power over his class that the more pedantic man can not have.

Every teacher should be not only a reader of books and current literature, but he should be a diligent student enthused with what he is doing. Students want to be loyal, and if a teacher has an admirable character, they will almost worship him. If he has faults, they accept them and make allowances; but they always identify themselves with their teacher. In this subject of prosthetic dentistry I know of nothing that gives a teacher so much power and influence over his hearers as enthusiasm, individuality, forcefulness and power of thought.

In reference to Dr. Hunt's paper, the effort he is making to establish principles is very commendable, and is what we desire, because if we can settle basic principles it will help us to devise methods of teaching. Very little has been done along this line, and, therefore, I am very glad to have the subject presented in this way. It will stimulate us all. It is desirable that we incorporate these ideas in our text books, and nowhere can papers be read with more benefit and profit to us as teachers than here.

The question has been raised whether we are not getting away from the original idea of this Institute by presenting papers, which, in the minds of some, should have been presented before a dental society. These are the very papers we want, because they will prevent us from becoming narrow-minded and doing work that will be of little value to us as teachers.

Dr. Hunt said that prosthetic dentistry is everything. Yesterday we thought that orthodontia and the four-year course was everything. Everything we bring up here seems to be important, and this is as it should be.

Dr. Geo. H. Wilson, Cleveland, O.

We have had some very scientific papers presented on this subject, but, it seems to me that the profession at large and the teachers are hardly in accord. A little less than two years ago one of our leading dental journals published an article written by a gentleman from the East discussing this very subject, and he made a strong plea for "mush" bites. I cannot conceive where there is any art or science or esthetics in the "mush" bite. In the same journal, the next article, read at the same State society, a teacher made a strong plea for art in dentistry, but before he was through he greatly lamented that gum section teeth were going out of existence. The manufacturers told him, he said, that there was not more than one set of gum teeth used today for ten of the others. It has always

seemed to me that gum section teeth had the same relation to plain teeth that ready-made clothing has to tailor-made clothing. The one is made for everybody and fits nobody in particular, whilst the other is adaptable to the individual.

A year ago, at the meeting held in Chicago, we had a great paper on prosthodontia. There were two main thoughts in the paper: The first, criticizing dental colleges and their teachings; the second, was a classification of the temperaments. In discussing this paper one gentleman criticized severely the scientific part that relates to temperaments. He felt that this could not be taught to a class. I wondered then how he could teach a science if not by such means as this, because science means a classification of knowledge, or what we call facts; and by classifying, or by formulating a system, as it were, we can present facts to the student. If it is not by this method, there is certainly but one method by which we can teach, and that is by intuition. And I would like to have some one tell me how to impart intuition to students.

Dr. Berry apparently has changed his methods from those he had a year ago. He has some very good ideas. Contrary to my preceding remarks I do believe that the profession and the teachers are ready for this high standard at the present time. I cannot agree with the doctor that the subject should be presented to this body under the heading of when and how only, but also what. I believe we all should be taught what to teach for the reason that at the present time we have no universal way of presenting the subject. We want to know more about each other's methods, and by presenting methods we can get an idea of what others are doing, and in time we will get together. Therefore, I approve fully of the papers presented.

The first paper contained many excellent ideas as well as facts; the fundamental fact, that of anatomical relation, was well dwelt upon, because we must understand the anatomical before we can understand the artificial. We cannot restore the anatomical once it is lost any more than we can restore the life that is fled. That is impossible. When a tooth is lost we are confronted by a condition that we cannot restore to the normal, but we do the best we can, and in order to accomplish that end we must possess a thorough knowledge of the anatomy. We must meet certain conditions; the question is largely one of physics. The laws of leverage are of importance. Before the teeth are removed the alveolar processes are well deeloped for the purpose of supporting the teeth. When the teeth are lost, nature proceeds to remove the process by receding upward and inward, in the upper, and in the lower it recedes downward and outward. So you can see at once wherein leverage plays an important factor. Is it possible that

we can arrange the teeth, so they are a reproduction of nature and yet have them well retained?

Dr. Cigrand advised that we arrange the teeth so they would point slightly inward. That is wrong, for the reason that force always is carried at right angles from the surface from which it emanates. If the upper teeth point inward toward the lingual surface, the force is applied over the buccal cusp, where there will be a tendency to push the plate outward. We should bring the teeth, as far as possible, directly under the alveolar process, and as nearly perpendicular as possible. This refers to the upper bicuspids and molars. (Black board illustration.)

That will apply in extreme cases where we must depart materially from the anatomical arrangement. For instance, with the molars we find that in order to retain the denture well it is better to carry the upper molars toward the middle of the arch, and the lower molars outward, so that the buccal cusps of the upper will strike in the sulcus of the lower teeth. That is not anatomy, but from the practical point of view in extreme cases it is decidedly a question of mechanics. We must impress upon our students the principle of leverage, and yet, at the same time, for the esthetic side of dentistry we must keep as close to the anatomical arrangement as possible.

Prosthetic dentistry is the art, science and esthetics of restoring a lost dental organ or organs by means of artificial substitutes. There are two kinds of art, the mechanical and the ideal or esthetic. I think it better to use the word esthetic to represent the one, and the word art to represent the mechanical. Science is classified knowledge. We should classify as much as possible so that we can present facts to our students. We need to have them learn the art side, that is, skilful manipulation; and then we must develop the esthetics.

When, how and where shall we teach these things? All minds are limited in ability to grasp ideas. I believe it far better to present one thought and make it fast than to present three and not impress any of them on the mind of the student. I believe the technic laboratory is the place where the student gets his first conception of correct principles. We start them in on mechanics, having them take impressions, etc., without burdening them with any special ideas of anatomy and temperaments. It is only a question of getting the hand at work; of doing something. After a while, in the lecture room, we can begin to teach them science. We can classify and explain to them why they did this and that. They can understand it then, because they have done the work with their fingers; they have something on which to base the principles we are giving them.

Then, after they have studied the science of prosthodontia, we can impress upon them the necessity of the artistic side, or the esthetics.

Dr. Berry brought out beautifully an idea with regard to the selection of teeth, especially the form of the teeth; a novel idea and a very good one, but what was the foundation of the form of that tooth? It was temperament which in that particular individual is true; but in the strongly marked lymphatic temperament peg shaped teeth would be indicated by the doctor's rule. The student should be taught that there are various temperaments. That there is always perfect harmony throughout every individual. That the color of his hair, eyes and teeth; that the shape of his body; that his mentality are harmonious. He must be taught the reason for seeing that harmony. We should always appeal to the student's intelligence in our teaching.

In the second paper much stress was laid on the artistic side of the question, which I think was excellent. One remark was made that at first I thought was not going to bring out the whole truth, and that was in regard to the muscles of expression. He said that the muscles of the upper lip are all elevators, but then told us that there is a superior depressor of the lip, and it seems to me that that is not, by any means, an unimportant muscle. Great stress was laid on restoring the cuspid eminence, which I think is very necessary, but at the same time I think we should lay stress on the restoration of the incisive fossa. In this fossa is the origin of the depressor of the upper lip. There are two branches to this muscle, one attached to the lip and the other to the septum of the nose. When the teeth are lost the aveolar process recedes, and the result is that the origin of this muscle is carried backward. Consequently the lip is drawn in or curled under, and the tip of the nose is drawn down. How can we ever restore that expression by padding? I say that it is absolutely impossible, because if we make the plate press on this muscle we are putting more strain on it when it is already strained too much. Therefore, great care should be exercised that the incisive fossa is not filled in too much. We must not exaggerate a condition that already exists.

Dr. W. S. Bebb, Los Angeles, Cal. I was very much pleased to hear Dr. Cigrand say what he did with reference to the importance of studying comparative anatomy in its bearing on the subject he presented. Unfortunately, this subject is much neglected in the dental curriculum, and yet it is of great importance in numerous branches of dentistry. Dr. Wilson said truly that "we could not make a perfect artificial substitute until we understood anatomical relations." To understand these we must know the sources from which they emanated.

Dr. Cigrand. I have enjoyed this discussion very much and consider it a great compliment. I expected adverse and drastic criticism because that, really, is what we

come for; that is the way we learn. We are here to learn. We are teachers. Yes, with a small "t;" and we are STUDENTS, all caps, as the printer would say. We are here to learn and whenever a method is presented that appears to be deviation or digression from what we have been teaching, you can assure yourselves that that is the best paper you will hear. There is always some opinion imparted in it. I always like to hear a paper on any dental subject, not only prosthetic dentistry, that is different from my views on the subject, because then I can learn, and I will continue a student as long as I live.

As to when I teach this? I teach it when I teach the anatomical arrangement of the teeth, in the freshman course. I devote the entire time in the freshman year to taking impressions in plaster of paris, and to teaching the anatomical arrangement of the teeth as I presented it this morning. Not a freshman in our school makes a crown or bridge. He takes impressions and studies anatomy of the face until he realizes what he is doing. When he is a junior he is in a position to understand lectures on crown and bridge work. My freshmen know only the anatomical arrangement of the teeth; the angles of the face, movements of the jaws and the laws of harmony. They have nothing to do with plate work in the junior year, but stick to crown and bridge work. And when they are seniors they join them all according to the laws of harmony and nature. We ought to get together on definitions and terminology if we want to express a certain definite idea in certain words and terms. That would be progressing very much.

So far as the teaching of prosthodontia is concerned, it is the same as prosthetic dentistry. But we ought to go further. We ought to have dental prosthesis, oral prosthesis and facial prosthesis. Dental prosthesis in the freshman year; oral prosthesis in the junior year, and facial prosthesis in the senior year. There are many things along that line that we ought to harmonize.

Dr. Hunt made a remark that brought to my mind a suggestion as to the setting of the teeth. I have my students diagram, draw and carve and rearrange the teeth. They cut forms of teeth out of yellow blotting paper and set them on jaws made of blotting paper. I ask them to study certain forms and they all get together and compare them. There is nothing that impresses the student so much as drawing, diagraming and modeling. I make them draw and diagram on the blackboard. Before I get through with them they can draw and model teeth beautifully.

An Ideal in Pathology.

By Dr. D. R. Stubblefield, Nashville, Tenn.

Teachers in dental schools are not supposed to deal much with ideals. This is mostly due to the fact that the dominant idea with the average dental student is to learn to *do* something. It is very easy to get his attention when there is "something doing," for his very fingers itch to get into the actual work. He is only happy and contented when he is blundering along in some attempt to do what he has seen done, or only heard of, without a clear mind-picture of the end aimed at. He may succeed by dint of luck or happy accident, but skill is only attained by him who first gets a clearly defined mind-picture and from that ideal works to a certain end. In other words, ideals must exist before definite results can be expected, whether in one or another field of human enterprise. Therefore, we would enter here a plea for better, clearer, more definite ideals as the best, even the most necessary foundation for all our work. We do not think this end can be attained by a happy-go-lucky, slipshod method, but it should be the intelligent aim of the teacher to get himself so saturated with the highest conception of his work that he will not be able to express himself without voicing his ideal to his classes. Set on fire by this ideal, he becomes the ideal teacher. All the world's great reformers have been ablaze with an ideal which could not be shut up within them, even if they were to be martyred for the utterance. They were the men with messages to deliver and they left an ineradicable impression upon their day and generation. While this is true the world is not altogether pleased with the idealist, or, as they say it, a "dreamer of dreams." He is looked upon as unsafe, as one who dreams while others work to do things. And

helplessness toward it. This is not as it should be, for there is no "ology" so abstruse that its essentials can not be rendered plain if we go about it in a plain, common sense way. At the same time we confess very freely that it was not long ago when it seemed impossible to get such a grasp on this subject which had not been thus simply impressed upon us, and it seemed almost unthinkable to get on intimate terms with it. An old friend used to say that when he was growing up they studied at college "Losophy, Gosophy and Phleanikislunk and nothing else, which put the college men above and beyond ordinary mortals." This always comes to mind when we find this idea of pathology being beyond the ordinary man still alive though possibly unacknowledged as such. But it can be understood if we take its simplest, initial principle away from its usual setting and digest it.

Inflammation

Let us say that every disease from whatever cause is an inflammation. An inflammation, according to the books, is interference or disturbance of the nutrition of a tissue or organ, characterized primarily by hyperæmia and accompanied by certain definite symptoms. In a word, it is just about what we gave as the definition of pathology, except that pathology is a discussion of the series of manifestations following upon an exciting cause. Pathology, then, for our use is only a *discussion of inflammation.* In this we find and present you our ideal in pathology.

To go one step further, according to the texts, the cardinal symptoms of inflammation are: "Redness, heat, swelling, pain and perverted function or febrile condition." These are the typical manifestations of the results or changes going on, which to be equally discernable must have an equally favorable locality to show themselves. Such a condition is rarely if ever found. We may have one or more present but from the nature of the case there can not be the same proportionate degree in all. Hard structure, as bone, will not exhibit redness or swelling; deep seated inflammations may be too far from the surface to show readily; and so on. But in all we find or have good reason to believe present, if not easily seen, disturbance of the circulation and perverted function in part or whole. Thus it is easy to establish the analogy between ordinary inflammation and any localized structural disturbance. This analogy is much more difficult to establish in the minds of the students when we take a more general systemic excitement as the illustration. This requires more mental effort, and mental effort they can not or will not make except after artful persuasion. Our eminent friend, Dr. E. C. Kirk, once said that the most insulting thing he could do was to compel his classes to think. Doubtless, all teachers agree more or less fully with that statement. A question that can be answered by rote is all right, but any turn or twist of an old,

familiar question that requires a little hard thinking raises a row. The very thing that education means, if it means anything, almost raises a mutiny, or, at the mildest, is an affront to their self-love. Yet to stimulate the growth of the mind, to accustom it to think should be the highest aim of every educator whether engaged in general or special work. Just here the inquiry comes to mind if that aim is not too often overlooked partly or entirely in our dental educational institutions.

To return to our subject. There can be no doubt that it is difficult to always clearly see the analogy between a localized inflammation, as a furuncle, say, and an idiopathic fever, but it is there nevertheless. We have only to think that the cause is acting more generally in the one case than in the other, and the results may be seen under the glass to be the same. We see the blood current accelerated in response to the excitant, the increase in speed and number of the leucocytes, the rise of temperature in both, the increase of size by this rushing of more blood to a special or general alarm, and a more or less decided perversion of function depending upon the extent or duration of the excitement. In both instances there develops an increasing exaltation of nerve susceptibility ending in pain if prolonged extremely. These general similarities must be considered broadly and the analogy must cease when the large lines of likeness are lost in the minutiæ of limited areas. Like the masterful sweep of the truly artistic brush, the minute is swallowed up in the salient forcefulness of the wide treatment and the discerning mind catches the idea and is satisfied. Students have not, as a rule, adequate discernment to hold a firm grasp upon the golden thread of the analogy, and once the end is lost they fail too often to catch it up again. Some of this uncertainty is doubtless due to the obscurity in the mind of the teacher. If the teacher is full of his ideal, he will very naturally recur again and again, like a spider weaving his web, so as to give his classes frequent opportunity to see it clearly and re-establish a strong connection with the central idea. It is our aim to present the broad principle of inflammation so simply that it not only can, but must be understood, never losing sight of it ourselves in any amplification. If the claim is made that it is too narrow, too much like the crudities of our earlier and less cultured years, we meet it by saying that teaching must be fitted to the taught without any reference to any preconceived ideas of fitness or technical fulness. One clear and definite idea is undoubtedly worth a multitude of vague and uncertain theories that can never be crystalized into sensible, practical cognitions. This applies to teacher and student alike. Therefore, if this simple, clear idea may be once established in the mind, there is something there that is his—something that he can digest and realize upon. He will soon be conscious of its simplicity doubtless, but from it as a basis he can surely reach out

to other things, certainly and logically deducted from that certain idea in his own mind. Without some such simple idea in mind he is never certain, and, like some wanderer in a bog, he goes falteringly from one uncertainty to another, fortunate if he succeeds in stumbling across, with no hope of return.

Oral Pathology. Let us now give some more practical application of our ideal to our own special branch, oral pathology. Take stomatitis, an inflammation of the mucous membrane of the mouth, ranging from the simple gingivitis to the most serious involvement of that tissue from a destructive, specific inflammation. Here we have a wide reach of conditions, from the infinitesimal and simple to the largest possible surface and complex specific involvement. The causation may, in fact does, differ and may be the all-important task for the physician to undertake, but the symptoms are essentially alike, differing in degree rather than in kind. We have the capillary engorgement, sensitiveness to pressure, the solution of tissue where the inflammatory process has culminated in degeneration, the increase in size shown in the tumifaction—in a word, all the cardinal symptoms of inflammation open like a book.

Again, in the diseases of dentition. As you remember, the text-books divide them into two classes: the true and the so-called. In the true, where the tooth germ, like any other tissue or organ, suffers from a real interference with its nutrition, we apply the measure as set forth above and we find local tenderness, redness, heat, tumifaction—in a word, all the symptoms necessary to establish its identity as a true inflammation. In the other, the so-called, we may just as easily prove the absence of all those symptoms locally and may boldly assert that whatever it is or is not, it is not a disease of dentition. Boldly is used advisedly in this connection, for the physicians will not always sustain you in this assertion. They have been known to diagnose the effects of teething in children who had all twenty deciduous teeth in position, and it is a bold, not to say a rash, dentist to stand up for his convictions in the face of the irate family doctor. In the so-called diseases of dentition there is certainly some disturbance of the nutrition going on and, as we see it, Nature is engaged in a great effort to rid the system, especially the alimentary canal, of a less or greater mass of indigesta, if not indigestible substances. To call such efforts on the part of our inherent health principle a disease of dentition is just as sensible as to look upon dentition as essentially a pathological process with or without complications. There may be an interference with the process of dentition, attended by all or enough of the cardinal symptoms of inflammation to clearly show a case of inflammation, but with gums normal in color, no intolerance to touch and none of the local signs of that

process, it is wooden, to say the least, to acquiesce in such an idea. In the so-called disease there is certainly an error of nutrition, the digestive function is all upset, but there is no reason in the assumption that it is a disease of dentition because this disturbance happens about the time when certain teeth are due and may be erupting without any of the signs inflammation.

In like manner we might apply our ideal to every form of that protean process called inflammation. It is not necessary that we find the certain cause of any inflammatory condition, although that is the wisest and best when possible for us to recognize the more or less definite presence of some or all of the cardinal symptoms; but when we can get this simple cognition as the basis of all such conditions we can feel that we can get on much more intimate relations with them and the pathology of all their breed.

And this, gentlemen, is the object aimed at in our discussion to-day.

Discussion.

Dr. O. E. Hertig, Pittsburg, Pa. It is with considerable embarrassment that I attempt to impress my feeble efforts upon this august body in regard to a field so vast and so impenetrable as pathology. One thing that impressed me on arriving at this meeting was the reason of our being here. One gentleman said we are here because we are teachers, and that we want to show that we are teachers. Another gentleman said that we are here as teachers with a small t, and as Students with a big S. The very existence of this institute is evidence that there is a weak spot somewhere in the teaching ability of the teachers of this country. We are here to exchange experiences; to learn and to profit. I am only a beginner in this field, but as much as I ever may know it still will be but little compared with what there is to learn. We are here to learn to teach; and one of the greatest missions of man is to teach those who know less than he does.

Why is it that we have such intolerably stupid material to deal with in our schools? Everybody says that the boys cannot think, and that you insult them when you try to stimulate their thinking apparatus. This is true to a certain extent only, because among the students you encounter some who have a decided capacity for clear and intelligent thinking—a capacity that often is lacking in more highly educated men. Why is it, then, that we have this stupid material to deal with? Ask yourselves. We are all teachers interested in similar institutions of learning, and we know that because the dental colleges receive such material is the reason why they are complaining about the lack of appreciation and the stupidity of their classes.

The remedy is plain. You all know it; I need not say what it is. With a class of men who have been taught to think from boyhood up; with a teacher aflame with an ideal as described by the essayist, then may we expect ideal results. In no field are these results more to be wished for than in the field of dental pathology. Ideals are delicious things to contemplate. We look forward to, and we strive for, and try to emulate an ideal. What is an ideal? The formulation of a thought in the man's mind of what he would like to do or be. Something that he conceives as being near perfection, and his idea of perfection exists only in the branch about which he is thinking. Therefore, there cannot be a definite mental picture without some practical experience in that branch.

Take inflammation. It is a long word and a big subject, and while the essayist says that all diseases are inflammations, yet there is some doubt about it. If we should stand before our classes and make such a statement some inquiring mind would ask if we still adhere to the inflammatory theory of dental caries. Dental caries is a disease just as surely as is diphtheria.

Simplicity and clearness in expounding is the ideal toward which we should aim in presenting a subject to our classes. Simplicity and clearness and the use of plenty of good common sense. One definite idea is worth a lot of mixed up stuff. That one idea means a clear, concise presentation of the subject, and while I do not agree with the Doctor in his theory regarding inflammation, yet his idea with reference to formulating something for his class is praiseworthy.

It has been a great problem with me as to how we can stimulate the students to think independently. I know that the occupant of every chair, no matter in what branch or subject, has the desire to create the impression on his class that all knowledge coming from that chair has emanated from the individual occupying it. This is true of all teachers, both in dental and medical colleges. Yet they are simply teaching what they have learned from books plus their own experiences in actual practice. After you have talked to a body of students for an hour on some subject, perhaps abstruse, you will notice that here and there one is going to sleep. He is not interested; he cannot comprehend, and his mental inertness makes him drowsy and dull.

How do our teachers of grammar, geography and arithmetic instil knowledge? How do the literary colleges do it? Does the teacher go before his class and lecture, and let the boys get just what they can? No. He has a text-book on every branch he teaches, and he assigns a lesson from which he will interrogate, and which he will enlarge upon and explain. And thus, by leading the student mind into the proper channel, the habit of thinking is inculcated and good results are obtained,

Dr. Geo. E. Hunt, Indianapolis, Ind. The paper is excellent, but it does not contain much about teaching pathology. The essayist stated that every disease, no matter what its cause, is an inflammation; that pathology is only a discussion of inflammation. I cannot agree with that for a moment because there are many diseases that are not the result of inflammation, and other diseases in which inflammation is only a symptom. The man who teaches that pathology is inflammation is doing a great wrong to his students. And, as Dr. Hertig said, inflammation does not exist in caries of the teeth. To say that inflammation is pathology and that pathology is inflammation is wrong. There is not the least analogy between a general fever and inflammation, and yet the essayist draws one.

Let us run over the pathology of inflammation. The first thing that occurs is dilatation of the blood vessels with increased rapidity of flow in the capillaries. The irritation relaxes the vasomotor nervous system and allows the arteriole walls to dilate, thus bringing more blood to the part. The same cause results in dilatation of the vein walls, and the fact that more blood is brought to the part by the arterioles necessitates an increase of speed in the undilated capillaries. Does that occur in a general fever? Not at all. If all the veins and arteries dilated there would be no circulation of blood in the body at all. It would stagnate in the blood vessels of the body. Later there is an exudation from the blood vessels beginning in the smaller veins. The leucocytes collect on the inside of the vessel wall and finally make their way into the tissues. Does that occur in a general fever? No. There is no analogy between an inflammation and a fever, except that in the early stages of each there is an increase in the nutritive changes occurring in the part affected. But in the later stages of inflammation there is a diminishment, almost a suspension, of nutritive changes, resulting in coldness instead of heat. I think the man who attempts to teach pathology on the basis that it is inflammation and that inflammation is pathology is doing his students an injustice.

I regret that more was not said about the methods of teaching pathology. That is what I want to learn, because I teach pathology. I have fought, bled and died for the subject of pathology before this association for many years, and our late lamented friend, Dr. Barrett, assisted in laying out my remains at Chicago last year on this same topic. I have a course in general pathology so that when I take up the subject of pulp conservation I do not attempt to teach inflammation. The student is supposed to have learned that before. In fact, he cannot understand the subject of pulp destruction until he has learned all about inflammation.

Dr. G. V. Black, Chicago.

The teacher of pathology needs to have a clean-cut idea of the subject; what it is, what it is caused by and what it leads up to in the end. Pathology is made up of a set of symptoms following upon something. The principal points in pathology with which we meet in operative dentistry, if I should speak of it in that way, only including a part of it, begins for the most part with the pathology of caries, with an injury produced, which as a sequence brings finally an injury to the pulp of the tooth. We have an infection and an inflammation, possibly a suppuration, that extends to the apical end of the root of the tooth. And then alveolar abscess and all the sequences that may come from that whose origin can be traced to the primary caries. We can trace the conditions from one to the other, and in this way arrive at a clear conception of the course that has been run and the existing conditions, and be ready to apply the proper remedy. We cannot teach pathology by any course of reasoning except by following these sequences step by step as they occur, thus gaining a history of the whole condition from its incipiency.

For instance: A few days ago a student came to me and said that he was not quite satisfied with a certain case. There is a swelling, supposedly an alveolar abscess, yet it did not present the usual evidences of abscess. I asked what were the conditions, the history of the case. "There are the molar teeth perfectly sound," said he, "and yet there is a swelling about the roots of one of them." I said, "Look further." There was one tooth missing. An exploration was demanded. It was made and the missing tooth was found below the roots of the other teeth. Here is an entirely different set of conditions. There was no alveolar abscess. By following up the conditions that presented themselves in the order indicated, by getting at the sequence of the trouble, we had no difficulty in arriving at a complete understanding of the case and the treatment was evident. That is pathology; having in mind the possibilities that may result or follow from a primary injury and in that way solving the problem.

Dr. Thomas B. Hartzel, Minneapolis.

Pathology is a pleasant subject to teach. In fact, no subject in the curriculum of our colleges today can be made more intensely interesting to the average student than pathology. No subject in the curriculum affords so wide and varied a field from which to draw illustration, and all of us know that no better method of teaching exists than that by which the teacher clinches the idea he has presented in the mind than by pointing out clear-cut analogies. For instance, the wonderful work done by one of the two classes of leucocytes chiefly concerned in the inflammatory process is beautifully illustrated and amplified by a close study of

the process of production of antitoxin now so successfully used in the treatment of diphtheria, and here let me say that I find students most keenly alive to this sort of illustration. Not only does the subject of inflammation take on more interest, but the subject of immunity as wrought out by the leucocytes seizes for itself a place in the mind of the student that makes him an attentive listener, particularly when immunity comes up for discussion. I thoroughly agree with the essayist that it is most essential that the teacher should possess a clear-cut idea of the end to be attained. In fact, in order to teach pathology and make the subject vital, he must have a good general education in medicine and have served in the various capacities in the post-mortem room, the pathological labori-tory and the general hospital; then only is he qualified with the illustrative material to make this subject interesting.

The essayist has made several points very clear, the most salient of which is the fact that inflammation is the foundation on which all pathological knowledge rests; that all disease is the result of some variation of the inflammatory process. This being true, our first task is to lay this foundation, and how can we best do this? I answer, by carefully following the laboratory methods of George J. Adam as outlined by him in his chapter on inflammation, written for Clifford-Abbot's System of Medicine, a résumé of which can be found in The American Text Book of Pathology, edited by Hectoen. It is deeply to be regretted that there has not yet been published a text book on pathology for dental students that is sufficiently comprehensive, and that is one of the reasons for some of the complaints we hear in regard to this branch. However, let us be inspired by a firm belief in the absolute necessity for intelligent comprehension of pathology to successfully practice dentistry. Educate our teachers to this view of the case and the subject will never lack interest.

Dr. Stubblefield. I see that I failed in transmitting the idea in my brain to the place where Dr. Hunt's brain ought to be, and I hope that he is not typical of the body that hears me. Now, Dr. Black presents the subject in a way that reminds me of a little game we used to play when children: You are cold or hot as you recede or approach. He says it is a sequence of changes, of structural changes; but dependent upon what? That was the idea I tried to present in my ideal. Please take the paper and digest it, and if it is not worth anything, why it is not the first effort that has proved futile and worthless. But I am going to keep on treating inflammation as the result of a cause, and the first essential rule is to remove that cause. The cause is either transitory or permanent. If permanent, its effects will be more or less permanent, and then you have this sequence of changes that Dr. Black detailed. If you remove the cause, resolution occurs. If the process goes

beyond a certain point, nature cannot bring about resolution, and the changes continue until there is complete dissolution.

Dr. Hunt said that there is no analogy between a local inflammation and a general idiopathic fever. Does an analogy between two conditions depend on an exact conformation in all things? Cannot you conceive that the structure in which the inflammation occurs will modify the type of inflammation? I did not say that this ideal is perfect because it is an ideal. I told you that the ideal may be wrong, as well as the idea from which it sprung, but I still claim that they did not set up any objection to the acceptance of the ideal.

Dr. Hertig said he would be knocked down if he said that dental caries is an inflammation. What are the symptoms of inflammation? Pain, redness, heat, swelling and perverted function. Is a tooth perverted in its function when it has undergone the effect of an irritating cause in the way of caries? What do these patients come to us for unless to re-establish function? Does solution of continuity mean nothing? Is not the cause the irritation present, but because it happens to be a hard structure the result does not show itself in the usual manner? We do not expect engorgement of capillaries in a tooth, but essentially the cardinal symptoms are present in a modified form that is due to their environment.

"Ethics, Literature and Hygiene." Our New Chair.

By J. D. Moody, D.D.S., Los Angeles, Cal.

Realizing the need of a more extended study of ethical relations than is usually given in a dental college, this chair was established three years ago by the College of Dentistry of the University of Southern California. So far as we could learn, there was, at that time, no such course in any dental college. An occasional lecture or two may have been given, but no mention of such has been made in the announcements.

There are to be found two or three apparent exceptions to this statement in the announcements of the North Pacific Dental College, of Portland, Oregon, and of the Medico-Chirurgical College, of Philadelphia, Pa. The former unites in one chair, "Dental Jurisprudence and Ethics," but it is in charge of a legal gentleman. While he probably will bring out the legal phases of ethical relations, he certainly cannot enter into all the particularly dental phases of the question, as a dentist can. The other college does not enter into ethical questions at all, but it does present an elaborate and admirable course in hygiene. This course is well worthy of

emulation by every dental college, but it does not present just those points which we consider of especial value.

One other announces a separate course in hygiene, but gives no details. Of course all colleges do teach more or less hygiene in some way; but it is in this practical, interwoven way of teaching it that we believe our plan to have the advantage.

It was also felt that the debt which we owe to our literature should have recognition, and this was added to the duties of the chair.

This was all virgin ground. We had no previous experience upon which to draw, no plans which might suggest other plans. We had to begin at the bottom, feeling our way as we went along. In the second year, owing to some professorial changes, hygiene was also added to this department, the title of which now reads: "Ethics, Literature and Hygiene."

In assuming charge of this work, the first problem which presented itself to my mind, was whether to plan for three separate divisions, or to weave them all together into one harmonious whole. The following solution presented itself:

By giving to the word "ethics" the modern, practical expression of man's relations to his surroundings, rather than the older and psychological one, I crystallized its meaning into the definition "Law of Duty." But the dentist's duty to—what?

That had to be worked out. Each year some alterations and additions have been made, and probably each succeeding year others will be made as suggested by experience, until finally it has assumed the shape we would have it.

Following is the course as it has taken shape thus far:

Ethics. Definition—"The Law of Duty."

Outline of Course. The dentist's duty to Self, Office, Patients, Profession, Dental Societies, Society (in general).

Literature. General: Library, Magazines, Papers. Dental: History of Library Journals—How chosen, How read, Writing for.

More than one-half of the time allotted is given to the consideration of the first part of this course.

These different subjects are taken up in turn and elaborated in detail in such a way as to give the class a high ideal as to the dentist's personality, his position in society and in the profession, and his duties thereto.

Throughout all this course, illustrations from actual practice are constantly introduced to emphasize the special points made.

Duty to Self.

The first section, "Duty to Self," assumes the need of a healthy body and a healthy mind as a prerequisite to a successful professional career, and outlines how to keep the one by the use of proper food, by proper exercise, occupation, rest, and personal hygiene, and the other by proper mental food, activity and associations.

The make-up of a modern dental office, in the four-fold phase of furnishings, equipment, convenience, and sanitary methods is fully illustrated.

The management of a first-class practice is explained in all of its details, including both the work done, and the relation between dentist and patient. This last point is especially considered, holding up before the class the ideal dentist, a gentleman always, sympathetic, firm, master of his position.

It was not considered wise to enter upon an elaborate course in general hygiene for the present, but hygienic principles and methods are so interwoven through all these studies as to emphasize their importance, and to impress upon the student the absolute necessity for their observance. This is found to answer every purpose, and in the light of our present experience we believe it to be the best plan.

The relation the dentist should sustain towards the profession and to the dental society is looked at from every standpoint; the students are urged to cultivate a spirit of professional pride, and shown how to make the most of their new relations. The ethical spirit receives especial emphasis in this section.

Dental Societies.

They are shown how much they need the dental society and how much the society needs them. The organization of a society is explained, and they are taught how to conduct one. They also receive instruction in writing papers for it; how to go about it, choosing the topic and why; what to include and what to exclude. The free and easy habits and expressions of the local society are contrasted with the dignified statements of the scientific or literary association, in such a way as to impress them with the importance of concise speaking and writng.

Dental Journals.

Dental journals are taken into the class, and attention called to some article which exhibits redundancy, or irrelevant matter that should have been omitted. Verbosity, and a loose mode of expression are contrasted with terse and exact language.

The printed discussions of some society are taken up in like manner, and hints given towards preparing such for publication. The ethical questions involving speaker or writer, publisher and reader, are brought out and considered.

College Society. To make all this the more practical, the senior class in each year is organized into a College Dental Society, which meets once a month, and carries on its work the same as any dental society. The jurors are invited to be present at these meetings, and in some ways to take part, thus being prepared to take up the management in the senior year.

Some of our meetings the past year have equaled in interest many of those of our more pretentious societies.

I am present at every meeting of this society in the capacity of a critic and counselor. If they are perplexed as to any procedure during the meeting, I help them out, and at the close I review the work and discussions of the evening, criticizing freely, just as a teacher would a class.

Literature. Under "Literature" an attempt is made to instill into their minds, as professional men, a love for literature and literary associations. They are taught something of the history of dental literature, biography and art. They are counseled in regard to the selection of a dental library, when and how to acquire one, what books to purchase and reasons given therefor. The dental journals are likewise considered, their merits or "field" canvassed, and advice as to a selection given.

This is but a mere outline of our work, but it shows something of what we are trying to do. We believe there is nothing like it. We believe that in a few years' course, this department, if generally adopted, would develop into one of the greatest factors in the upbuilding of our profession.

The Value of Instruction in Dental History and Literature.

By H. L. Ambler, Cleveland, Ohio.

The subject of teaching History in Dental Colleges is well worthy of our sincere consideration, because it will naturally stimulate students to want to know more of their profession's past; it will make them desire to attend societies, subscribe for journals, purchase books and read them; any or all of these may lead to the conception of ideas which will be valuable.

Teaching history affords the main opportunity for students to know of and appreciate the science, evolution and progress of the profession, and will create in them a wish to learn more of collateral branches, and this will lead to fondness for good literature in general, and make them

better citizens, because they will have broad ideas, and it will also make dental graduates equal to graduates in any profession.

Teaching history is favorable to producing scientists, because it tells of what has been done, and how it was done, thus stimulating the mind of the hearer and prompting him to emulate some of the noble characters spoken of—it imbues him with enthusiasm, and he will aspire to great things.

If you impress the minds of students with history, they will have a higher regard for the status and dignity of their calling, and the impressions they will make, and the influence they will have on their fraternal brothers, and also on the laity, will redound to their honor.

History should help to guide students and to stimulate effort along lines of invention and discovery, and those who study it will naturally assist in making it.

It is for the intellectual and material benefit of the student to study history, because it makes him intrinsically greater, wiser and better, and teaches him to honor the memory of notable men.

History of the best things tends to do away with quackery and empiricism, ignorance and error, and increases our resources.

Teach history so that students may know what was done in ancient times, and where dentistry originated, and when, and by whom important discoveries in our specialty were first made, and what dentist discovered practical anesthesia, or made certain surgical operations, or applied certain mechanical principles, or wrote the first books on our specialty. One cannot be progressive without knowing more or less of history, because he might be going backwards in trying to develop some idea or material thing which had become obsolete before he entered the profession.

In order to fully understand the steps which have been taken to bring dentistry up to the present standard, one must study history, which is one of the factors that helps mold dentistry into a profession.

With the dental student, who is longing for information, everything that has to do with the history and progress of dentistry, is studied with interest, especially the rise, fall and revival of dental art; he must learn of the origin of the science and art, or he cannot determine its progress or appreciate its advancement. He should be made to feel that he owes much to those who made dentistry a profession and invented methods and instruments which he will use daily, the products of which are a necessity in every community.

The student should be taught history so that he will understand that he does not know everything, and is not in advance of all of his predecessors, but that some of their work has been relegated to him for completion.

You can interest students by occasionally giving short biographical sketches of some of our most noted men.

There is no longer any excuse for not teaching this subject as we have a text book, and also four college years of not less than seven months each, in which time can easily be provided.

History Taught in Professional Schools.

No other of the learned professions omit such instruction. What would be thought of a theological school which would plunge its students headlong into the dogmas of its particular sect without first dealing with the history of religions? Such a school would be very narrow, indeed, and yet gauged by the same rule, dentistry is more narrow than theology. What would be thought of a law school which did not teach the history, emanation and foundation principles of law? Such a school would probably give a student, by way of introduction, a case to "try."

What would be thought of a medical school which did not tell its pupils about Esculapius, Hippocrates, Galen, Hunter and others? Such a school might give a freshman a case of typhoid fever to treat.

Schools of painting and sculpture go back to ancient and medieval times for their history and ideal types.

We believe that if every college would provide for a reasonable course of instruction in the history of dentistry, showing how it has gradually evolved a literature vast and comprehensive enough to occupy all the attention of any one mind, that our specialty would be broadened because of the knowledge thus disseminated.

Value of Teaching History.

History shows that our profession is on an equality with several other professions, and gentlemen in these professions should treat each other in a noble manner, and in accordance with their scientific attainments.

Students should learn that dentistry has a record which they need not be ashamed of, and a literature of its own which is receiving large yearly additions; also that highly educated men of the past and present are engaged in its practice; knowing this will be a great factor in causing pupils to strive with all their powers to be a credit to their calling.

History induces in students, respect, veneration and love for their work, and impresses more than ever upon them that it is a profession.

The profession should honor the man, and the man should honor the profession, and this will be more apt to be done if pupils are told about the good things of the past as well as present. They should be taught so that the world at large will consider them as well equipped in their profession.

as any other man is in his; thus he will gain standing, prestige and influence, which will be of incalculable benefit.

Some of the antagonism which has been shown towards our profession, has been directed to lack of proper literary training.

They should be taught so that they may be able to defend themselves from the attacks of those who do not appreciate the large amount of study, work and experiment which has been given for the purpose of relieving pain, preserving and restoring organs of the body, and adding to the longevity of the human race.

History helps put a man in his true position for future usefulness, and it is impossible to keep abreast of the times in this inventive and progressive age, without at least knowing our present and passing literature.

"The thoughtful reasoning reader will find a mine of value in history, and mentally add to his storehouse of information laid aside for the future, and the use which is made of this knowledge will depend upon the individual; one finds pabulum for future essays, another will find hints which lead him to deeper investigation and original productions."

One evidence of progress is the ever increasing interest manifested in historical research and study of collateral branches, and the profession is gradually comprehending that the proper way to learn lessons of wisdom for the uncertain future is, to give immediate attention to the events of the past. If we remain ignorant of the history of those who preceded us, we are liable to make many sad mistakes. Another evidence of the fact that history is attracting more attention than formerly we note that the National Dental Association has appointed a committee of twelve on this subject, and the "Southern Branch" has also a committee, and at their last meeting Dr. G. S. Vann, in his paper said: "A chair of dental history and ethics should be established in every college so as to develop a nobler strain of professional life."

Other evidence is that several of our colleges already teach more or less of the subject.*

"Teach history so that pupils may realize how deep down into the soil of history run the roots of the life that flourishes in the profession. Here great events have happened; here great deeds have been done; here great men have lived and flourished and labored; here the fascinating story of the growth of the profession is told."

History teaches that the dental spirit is one of unrest, full of anxious brain power, continually reaching for something better, coupled with nimble fingers, bright eyes, good judgment and perseverance, and the watchword is, and ever must be, onward toward perfection.

*Colleges which teach dental history: University of Illinois, Prof. B. J. Cigrand; Philadelphia Dental College, Chas. McManus, D.D.S.; Louisville College of Dentistry, Max M. Eble, D.D.S.; University Southern California, J. D. Moody, D.D.S.; Western Reserve University, Prof. H. L. Ambler; Barnes, St. Louis, Dr. B. L. Thorpe.

Discussion.

Dr. C. McManus, Hartford, Conn. Dr. Ambler has covered the ground so completely that I feel that I can add very little of value to the discussion of this interesting subject. It is certainly gratifying that a body of teachers should consider it of sufficient importance to give it their attention at this time, when our colleges are about to begin a four years' course, and the former valid excuse of lack of time for its proper consideration can hold good no longer.

In the four years which the future dental students will spend in getting their professional training there is certainly ample time for what Dr. Ambler has conservatively termed "a *reasonable* course of instruction." It is not necessary that every dental college should have its "Professor of Dental History and Literature," nor that an exhaustive series of lectures should be given on these subjects, but I feel that the college of the future will not be doing its full duty, if it continues to entirely neglect such a means of broadening the professional character of its students.

Dentistry is not alone in the neglect of the study and teaching of its history—we stand side by side with medicine in that respect. Over thirty years ago Duglison speaks of students being "left to gather their information on the previous state of medicine in whatever manner they may find it practicable or convenient to do so after graduation."

Twenty-five years later Dr. Roswell Park, of Buffalo, writes: "The history of medicine has been sadly neglected in our medical schools." Thirty years ago the great Virchow wrote "that the scientific knowledge of young physicians reaches only three to five years back."

Braatz says that "the history of medicine was taught as a regular branch in fifteen German-speaking universities many years ago, but it is kept up now in only one or two. Nevertheless," he says "the medical graduate needs the story of the past in order to appreciate the present, to uphold the traditions in professional ethics and for many other reasons," and he pleads "that this instruction should not be neglected."

Duglison's "History of Medicine" was the outcome of a series of lectures delivered many years ago before the students of the University of Virginia and Park's volume was the result of an attempt to give systematic instruction to the classes at the University of Buffalo. Dr. Park says that it is a source of the greatest satisfaction to him that his sincere hope has been fulfilled, in that the profession generally are now manifesting a deep interest in this important subject. I simply state these points as an evidence, that not only in past neglect, but in present interest, we are closely in touch with our old friends of the medical profession, not only in this country, but in Europe.

Properly presented to the student, the history of the profession and its literature, has a very *practical* as well as an ethical value.

Dr. Black struck the keynote of the whole matter when he said that "a history of dentistry should be, not a history of men but a history of *the progress of thought* in dentistry."

Carrying out this idea the students could be guided, by the teachers, in their reading and sent to the college library, and museum, to follow up, through the old books and journals, and by the study of the instruments and appliances of former days, the development of modern dentistry. It could not fail to interest them as they would come upon so many old ideas that would seem to them so new—and be made to realize that some of our modern devices are so old.

In this way—a sort of laboratory method of studying history and literature—they would be getting their information in the "original package" and would not be in so much danger of "knowing so many things that ain't so"—to quote that eminent philosopher, Josh Billings.

Dr. Ambler has said, "If you impress the minds of students with history they will have a higher regard for the status and dignity of their calling."

It is here that a proper consideration of dental biography may have its lasting ethical value in forming true professional character.

Dr. S. G. Perry has beautifully said: "I am impressed with the thought that we have a great deal to be thankful for in being members of a profession that can make such an array of names of men who could grace any calling on this earth at any time and it is proper that we should stop to historically consider these men, and that we should occasionally lay aside scientific questions to think of these things that really touch the heart so deeply."

It is this practical and ethical value of instruction in our history and literature that makes it worthy of the attention of all having a true interest in dental education at heart.

Dr. B. J. Cigrand, Chicago, Ill.

The dentist who is ignorant of the beginning of his profession and is not familiar with the trials of the early forefathers is not unlike the patriot who glories in the triumphs and achievements of his native land, but knows nothing of the making of the established institutions he so blindly loves. The dental student who acquires a knowledge of the evolution of his prospective profession, will be more likely to cherish more dearly the heritage bequeathed by the giant minds who laid its broad foundation. In fact, if the students were required to study the biographies of the founders of our calling they would recognize the merit of self sacrifice and devotion of the pioneers and would more keenly appreciate

the honor of the conference of the degree of Doctor of Dental Surgery. If the students understand the heroic efforts made by men like Hayden, Harris, Hudson, Gardette, Randall, Wells, Townsend and Wescott, and study the careers of such distinguished educators as McQuillen, Cushing Garretson, Allport, McKellops, Taft and Barrett, they would scorn the fellow classmate who would dare to violate the code of ethics and despise him who aims to commercialize every feature in the noble purpose of our vocation. The study of the biographies of even such of the living as Black, Williams, Miller and Marshall would contribute liberally towards establishing in the minds of the students a sense of reverence and respect. I quite agree with the famous Englishman who said that "the history of any nation is but one of biography of its great men." It is equally applicable to the history of a profession, and for this reason I have during the past eight years given a special course of lectures on the biographies of the individuals who have laid the basic structures of the science and art of dentistry. Besides the course includes a clear résumé of the origin, development and present standing of the various dental bodies, thus familiarizing the students with the purpose of the dental societies and associations, and emphasizing the importance of identifying themselves with dental societies calculated to broaden their knowledge of dental procedures, and assisting in the great work of constructive gatherings.

I believe it was Lord Bacon who said, "Every man is a debtor to his profession," and he certainly was correct, hence let us contribute our quota to the great cause and a certain method, promissory or begetting love of profession can be found in the study of the history of our profession. Through this channel we can improve the minds of our student body and inculcate a desire to emulate those who have so cheerfully toiled to make ours a dignified calling.

J. H. Kennerly, M.D., D.D.S., St. Louis, Mo.

Goethe, in his fundamental work on education entitled "Wilhelm Meister," expresses the thought that to understand one's profession thoroughly it is necessary to know its history. The very significance of this aphorism is self-evident. The struggles and strifes of the forefathers of our profession for the development of the unknown factors which govern the routine work of a successful dental practice are not alone interesting from an historical point of view, but by their study we give to our own mind and that of our students' the power of cultivating logical reasoning. The inventions and discoveries of the various appliances of our armamentarium are of immense benefit for the rapid execution of our daily work, and a knowledge of the various steps which were instrumental in bringing them to the present point of perfection is of still more importance, as it will prevent the so-called dis-

covery of methods, which have been cast aside, and on the other hand, form a solid guide-post for the progress and development of procedures which are still in their infancy. Further, if a closer acquaintance with these facts were generally to be found amongst the profession, many of the costly lawsuits involving new fangled ideas in regard to the construction of a certain crown or bridge, could be quickly and successfully averted by simply referring to historical data obtained from existing literature. The celebrated lawsuit Allen *vs.* Hunter (Continuous Gum) and the Goodyear vulcanite case, will be remembered by many of those present. On the other hand, by the study of the history of a profession, a discovery, invention, or the performance of a certain operative method, is more certain to be credited to its rightful originator. To illustrate this particular point more fully let me cite to you the following interesting bit of history:

Work of Early Dentists.

In 1851 Dr. S. P. Hullihan introduced an operation which in dental history is known as Hullihan's operation "Rhizodontypy." It consists "in making a hole through the gum, the outer edge of the alveolar process and the root of the tooth into the nerve cavity and then in opening the blood vessel of the nerve? While this operation had been already practised by Hunter and Fox, a closer study of the works of the Latin medical writers reveals the fact that Archigenes, who lived about the year of 100, used "a small trephine to drill into the middle of the tooth to relieve the pain" from a dead pulp. The same operation was much lauded by Pliny, the older, who, however, to obviate the pain arising therefrom, advocated the use of a local anesthetic, the *"lapis memphiticus,"* a stone somewhat similar to onyx which was powdered and mixed with vinegar and then spread over the affected part. Again, the question when and by whom were the first gold fillings placed in teeth, is extremely interesting from an historical point of view.

In one of the later American works on dental history, the following statement is found: "One of the mummified bodies of an Egyptian Pharaoh demonstrates most conclusively that natural teeth were not only well cared for in the way of gold and lead filling," etc., quoting as an authority the *Papyrus Ebers.* As a matter of historical fact we would like to state in Joachim's authorized translation of the Egyptian Hieroglyphics of the *Papyrus Ebers,* no such statement can be found. On the contrary, the late Professor Ebers writes in a private letter in 1895 to Dr. Jacobi, of Frankfort, as follows: "In spite of the minutest investigations in regard to the filling of teeth in the mummies of Egypt, I can only record negative results." The celebrated craniologist, Professor Emil Schmidt, of Leipzig, who possesses several hundred crania of mummies,

adds to it thus: "In no one denture did I find anything that could be traced to the work of a dentist—no filling, no filing nor preparation of a carious defect; no artificial dentures." In 1728, Fauchard published the first edition of his work, *The Dental Surgeon,* and he is the first authentic author who gives a definite description of filling teeth with metals, employing tin, lead and gold. However, gold fillings are mentioned long before this work of Fauchard appeared, *e.g.,* in the writings of the two Italians, Vigo and Arculanus. Giovanni da Vigo, the Genoese (1460-1520), was connected with the medical school in Padua. He writes quite at length about the extraction of teeth, being bitterly opposed to the performance of this surgical operation *"In publico banco vagabundis charlatanis."* He advises the use of arsenic and sublimate for the treatment of old fistulous openings, and merely mentions the possibility of filling a tooth with leaves of gold. Da Vigo's work appeared in Latin in 1514; an English translation of this surgery was published in London in the year 1550. Giovanni d'Arvoli, or as he styled himself according to the uses of learned men of his time, "Johannas Arculanus," was a professor of medicine in Bologna, dying in 1484.

The Teaching of Dental History.

The teaching of dental and medical history in the colleges and universities is still in its infancy. While there is in some European universities a special chair of medical history, as for instance in the University of Berlin, the United States has been rather slow in recognizing this important subject. The University of Maryland is at present the first and only institution which has a regular professorship of medical history incorporated in its faculty. As we are informed, Dr. McManus, of Hartford, Conn., has delivered a series of lectures relative to dental history to the last year's class of his Alma Mater, the Pennsylvania College of Dental Surgery. Dr. B. J. Cigrand also fills a chair on this subject in the Dental School of the University of Illinois. These are probably the only three known courses of lectures on dental or medical history in the United States. In the other schools, the various professors usually refer to the history of their relative subjects in an introductory lecture, or during the progress of the course. Concerning the literature of this extremely interesting subject let me say just a few words. As far as I am informed there are only two works in the English language which teach dental history and they do so in a somewhat hasty manner. The first and most important is the history of dental and oral science in America published by authority of the American Academy of Dental Science in 1876; the other, entitled "The Rise, Fall and Revival of Dental Prosthesis," by Dr. B. J. Cigrand, of Chicago, Ill. There are still others which might be mentioned, namely, "History of Medicine," by Parks, and

the English translation of the German work of Herman Peters entitled "Pictorial History of Ancient Pharmacy," and the "History of Medicine." All are extremely valuable. Dr. Jacobi, of Frankfort, Germany, has published a little work entitled "History of Dentistry," a very interesting book of great value, although somewhat limited in its scope. There is another work published in the French language, which, while of value, deals primarily with dental history in France. As a guide to the literature, the late lamented Dr. Taft, who was primarily selected to read a paper before this body, has compiled an index to the periodical literature of dental science and art as presented in the English language and "Sternfeld's" dental index are very useful and important works. Dr. McManus has published important personal sketches of the forefathers of our profession. Dr. A. H. Fuller has also published an interesting paper on the same subject. Dr. Wm. Trueman, of Philadelphia, has contributed largely to the general dental history in the various journals, and a series of personal sketches of the older men of our profession has appeared in the *Dental Review* by Dr. B. L. Thorpe. The older dental journals and text books furnish an abundance of valuable information, and it is to be hoped that some of our able men like Drs. McManus and Trueman will in the near future furnish us with a more complete history of the dental profession.

Dr. Burton Lee Thorpe, St. Louis, Mo.

Until within the past few years our profession has paid little attention to its early history. I doubt if any other profession has as meager knowledge of its origin as ours.

In our college we consider dental history an important branch. In my course on this subject I begin with a review of the subjects appertaining to mention of dental operations B. C., following with a review of the theories and methods advanced by Fauchard, Chemant, Celus, and John Hunter, who enters at some length into details of tooth development, theories on caries, inflammation of tooth tissue, and suggestion on treatment.

Le Merle's *"Histoire de l'Art,"* and G. P. Geist-Jacobi *"Geschichte der Zahn-hul-Kunde"* works are worth reviewing; also the works of Joseph Fox, Alex Nasmyth, John Bell, Leonard Koecker, Duval, S. Fitch and John Tomes' Lectures of 1848. Chapin A. Harris, while editor of the *American Journal of Dental Science,* contributed many articles of historic and scientific value to that journal and did future teachers a great benefit when he translated and published in his journal the works of Baume—*"Treatise on First Dentition."* Garrot—*"Diseases of the Mouth.* Jobson—*"Treatise on the Anatomy and Physiology of the Teeth."* Lefoulon—*"Theory and Practice of Dental Surgery."* Dela-

barre—"*Second Dentition.*" Blandin—"*Human and Comparative Anatomy of the Dental System.*" Desirabode—"*Elements of the Science and Art of the Dentist.*" Jourdain—"*Diseases and Surgical Operations of the Mouth.*" Besides valuable treatises such as Berdmore, "*Treatise on Disorders and Deformities of the Teeth and Gums.*" J. Waits, "*Facts Connected with the Teeth.*" Blake, "*Structure and Formation of the Teeth in Man and Animals,*" and T. E. Bond's "*Practical Treatise on Dental Medicine,*" all of which give interesting points for a course on history. To briefly review the various theories and modes of treatment of these authors, to briefly take up individually, from a biographical standpoint, the characteristics, theories, methods, inventions, literary contributions and professional attainments of the many good men who helped to build our profession's superstructure, and who are the real makers of dentistry is of more than passing interest. These lectures are made more interesting by illustrating with lantern slides.

The three most potent factors in our profession's history, from an educational standpoint, are the college, the journal and the society. The origin and work accomplished by each should be reviewed. The early volumes of the *American Journal of Dental Science, Dental Register of the West,* and *Dental News Letter,* and other of the early journals will give much information of interest. The committee on history for the Fourth International Dental Congress are attempting a work which, when completed, will add much to dental history, viz.: the gathering of data making a complete report of the organization and work accomplished by each dental college in the United States.

Each college should furnish, as soon as requested by the committee, a brief, concise account of all historic data connected with the organization and following events of interest. Someone has said: "Who knows not another language cannot understand his own." To properly appreciate just what we are we must first realize what we were. The National Dental Association, Committee on History, has done much in the past few years in exciting interest in this very important subject and deserves financial aid to successfully carry on and complete this work. The history of dentistry cannot be written in a day or by one man. The systematic co-operation of all who are concerned in historical matters is needed, that, by united effort we may rescue from oblivion many important facts that, when properly compiled, will give us an *absolutely authentic history.*

The efforts, along this line, of Wm. H. Trueman, Jonathan Taft, B. J. Cigrand and Chas. McManus deserve especial commendation.

Now that we have a four-year course and plenty of time to teach this subject there is no reason why a chair on dental history and literature

should not be taught in all colleges. To know and appreciate the events of our infancy and growth and the attainments of the men who are a composite of dental patriot, pioneer and pathfinder is both instructive and of lasting benefit to the student.

Dr. G. V. Black, Chicago, Ill. This is a subject in which I am deeply interested, and I would like to see it pursued more closely in the future than it has been in the past. We have a great deal to do in the searching out and tabulation of data on this subject. We seem to have lost sight of the literature of the past, and our students know little or nothing of this literature. In our present college course we have not the time to give them a proper résumé of the subject. There are many things that could be given to the student with reference to dental history that would be of interest. For instance, the oldest data I could find with reference to gold filling was in a German book, published about 1530. The author seemed to understand the filling of teeth with gold and he quoted from others who wrote considerably before his time. This, so far as I know, is the oldest printed record of this operation.

I am sure that with proper search and going over of old books we may go still further back and find data of great importance to an understanding of the development of thought upon this subject. For after all, while the history of man is important and interesting, the great point is to arrive at the development of thought along these lines.

Dr. R. H. Hofheinz, Rochester, N. Y. I have been very much pleased with this paper. I always feel sorry that I can give my students but a short history of dentistry owing to lack of time. I believe that there is no one thing that will stimulate the ethical feeling of the student so much as this matter of dental history. As one speaker remarked: "What does patriotism depend upon?" It depends largely upon the history of the nation. It depends largely upon the reading of and knowledge of that history by the people. It is exactly the same in dentistry. If our students lack that patriotism for dentistry, which they must get largely through this learning of history, they are lacking one of the most essential points necessary to success. Dr. Patterson, in his paper at the beginning of this session, spoke of the lack of ethics in schools. I do not believe that there is any other subject that will produce better ethics than the teaching of dental history.

I do not agree with Dr. Thorpe that history should be taught exclusively in the fourth year, because the sooner you develop this feeling of reverence for our science the better you apply the teaching of history. I believe dental history should be taught to the freshman classes because at that time they need as much ethical training as ever afterwards. It will

bear repetition in the senior year. It should be made more interesting by biographical sketches because these are entertaining, but when the course is repeated in the fourth year the biography should be secondary.

I am very sorry to know that so little history is taught in our dental schools, and also that the German universities have given up the teaching of the history of medicine. Of course, there is some difference. The history of medicine is well established. It has been taught for centuries. But dentistry is too new to have a well established history. Such men as Trueman, Black, Willmott and others should contribute to history by writing their biographies, so as to stimulate the coming generations in their admiration for what has gone before them.

Dr. Thorpe. Dr. Hofheinz misunderstood me. I did not intend to say that dental history should be taught only in the fourth year. I said that now that we have the four-year course there was no excuse if we do not find time to teach dental history. Another point I omitted was the use of the lantern slides showing the various appliances used in the past, and also photographs of the pioneers in dentistry.

Dr. J. B. Willmott, Toronto, Can. I wish to give expression to two thoughts with reference to the history of dentistry. I heard no mention made of a work entitled *"History of Dental and Oral Science in America,"* published as part of the Centennial celebration of 1876, edited by James E. Dexter, of New York, and published by the S. S. White Dental Manufacturing Co. I purchased a copy of it and was delighted with it. In the absence of a systematized course on history this work furnished the teacher of operative and prosthetic dentistry with much information as to the development of practical dentistry.

One matter of special interest is the history of the "amalgam war." It greatly helps the student to understand the proper position of amalgam as a therapeutic agent.

Another point I wanted to make: The authorities of the corporate body of dentists of the Province of Ontario have sent out circulars to all men in practice previous to 1870, asking them to furnish a biographical sketch of themselves; the kind of instruction they received in dentistry, and the conditions under which they entered upon the study and practice of dentistry; giving some idea of the practice of dentistry as carried on at that time. We received responses from about thirty undertaking to furnish us with information. I think these thirty papers will give us a fair basis on which to start a history of dentistry in our Province.

Dr. G. V. Black. I want to say another word about the tabulation of data. About four years ago, acting on my advice as a means of studying dental literature, my son, Arthur, set about making a card catalogue of dental literature. He has run well up into the last century and has some thirty thousand cards of this catalogue completed, thus furnishing us with a ready means for looking back upon any point in the history of the profession. This should be done not only by one man but by hundreds of men, and it has been a question in my mind whether we could organize a system of card cataloging that would take in, perhaps, as many as have considerable libraries, or as many as read carefully and closely and are interested in the subject. There could then be an interchange of cards. We would get at exact data, and in a form in which they could be transmitted and yet be of very little expense to anyone. I throw this out as a possibility of the future, and I hope that some of you will take it up.

Dr. W. S. Bebb, Los Angeles, Cal. In the University of Southern California we have had a chair of literature and ethics for three years. I believe that the influence of this work is felt, from the fact that in our district out of 170 eligible members to a dental society, 140 belong to the Southern Californian.

Dr. Willmott. Some years ago, in connection with our college library, we undertook to get up a card index of five of the leading dental journals. We commenced from the date of Dr. Taft's index and indexed the five journals very minutely so that we can refer to any writer or subject that has been discussed during these years. I shall be very happy to extend the courtesies of our library to any member of this association.

Dr. Ambler. I wish to correct two or three statements made by those who discussed my paper. One gentleman said that the first time that dental history was taught was about three years ago. That is a mistake. The first teacher and the first college to teach dental history are located in Chicago. Dr. B. J. Cigrand first began to teach dental history about nine years ago. He is the pioneer.

Another statement was made that there are only three colleges that taught dental history. I have a list appended to my paper of seven schools that teach this subject, and I feel confident that this does not include them all because I did not have all the catalogues of the dental schools of this country.

I fear that I have written rather a tame paper because no one has found any fault with it, yet I feel grateful for what was said because I have learned much from the discussion.

Porcelain Technology.

By Hart J. Gosler, D.D.S., Chicago, Ill.

Although the primitive, practical and successful application of porcelain, or of the ceramic art, to dentistry, probably antedated the advent of dental colleges, and while it is true that the subject has occupied a place in the curriculm of a majority of the well equipped institutions since that time, still it is only within a comparatively few years that it has been regarded other than as being a distinctively separate, and, in most instances, perhaps unimportant part of the course of instruction, and hence it was generally taught accordingly, or, at best, in a more or less perfunctory manner.

This attitude, however, may be accounted for by the fact that a successful application of this particular class of work was then and has been generally regarded as demanding so high a degree of special fitness, and that it further encompassed a field of usefulness so restricted by limitations as to offer but meagre opportunities—pecuniary or otherwise—for the average practitioner of that time.

For these reasons, and since its application was thus for so long a time confined exclusively to the construction of continuous gum dentures, the restricted growth of the art and of the development of its possibilities naturally has led to the slow process of evolution experienced.

The Old School.

To the work of John Allen, Moffett and Ambler Tees, of Close, Haskell, Beauman and a few others, who represented and who still represent what might properly be termed the "old school" must be attributed the inspiration and stimulation which have encouraged the recognition and development of these possibilities.

Indeed, such credit is due to them as to make it entirely unbecoming in me to pay tribute to their efforts and perseverance. And yet, if you will indulge me in prefacing this subject with a retrospective preamble, I desire to submit that we as teachers, in the present period of progress, must not overlook the conditions and difficulties under which their efforts were made, nor fail to acknowledge that the energy, perseverance and enthusiasm displayed by them has made it possible for those of another generation to comprehend and appreciate the value of their contribution to this evolution.

The esthetic and hygienic advantages which they early recognized, and which made the application even within such a limited field so pre-eminently successful, gradually promoted the realization of a greater scope of possibilities than they probably ever anticipated, and created a desire for the achievements which a more general and extensive application to fields of even greater usefulness would afford.

The New School.

As this appreciation increased, others became encouraged and enthused, and thus the process of development was marked by the advent of what we may now term the "new school." The apparently radical statements of Land, Parmley Brown, Jenkins and others were accepted by some, and a few worked earnestly with these men in the further development of such possibilities as they predicted; but the great majority were either skeptical or indifferent, or else belonged to that class whose more or less ultra-conservative views and tendencies caused them to regard such claims as being those of the "faddist," and such efforts as being only those incident to the promulgation of a "fad."

The stimulus engendered by the efforts of these enthusiasts, however, and later on by those of one or two in the East and of a handful in the West—principally in Chicago—has resulted in the development of porcelain work to such a general application and to so high a degree of esthetic perfection as to firmly establish it as an *art* which is undoubtedly destined to occupy a permanent and conspicuous place in the practice of modern dentistry.

This advancement has been made possible to a large extent, it is true, by the increased and constantly improving facilities and products which are furnished by the manufacturers; and yet, as a matter of fact, and without any desire whatever to detract from the credit due them, these increased facilities which are now at our command and which have so materially aided in perfecting and expediting the procedure, have been furnished to us very largely as the outgrowth of suggestion and demand on the part of the profession.

Like all new departures and methods, the application of porcelain

work has been abused by indiscriminate and injudicious employment. This, however, is only a natural sequence, and is due to the fact that *judicious employment* can only follow a well defined familiarity with the requirements and limitations, and that these can only obtain as the direct results of the acquirement and development of skill.

Duty of the Colleges. Hence, if the modern application of this class of work to the filling of teeth and to the construction of crown and bridge-work is generally acknowledged as being practicable, which is now conceded, and if it is then in turn acknowledged that *successful employment* is dependent upon a definite knowledge of the fundamental principles and requirements and upon the acquirement and development of *skill, then*, the dental college of today must do its *duty*—toward itself, and the student body and toward the advancement of the higher esthetic attainments of the profession.

If this be logical, then the teaching of porcelain work in a broad and comprehensive manner, so as to include the various phases of its present successful application, has now become a necessary and important addition to the dental curriculum.

Just what a thorough course in the technology of the subject should embrace, just how much time should be devoted to it and how it may best be elucidated is doubtless a matter which will work out its own salvation, and which is largely dependent upon the views and experience of the individual teacher and upon the environments of the college.

All teachers will, of course, agree with me in the value of technical training, as well as in the necessity for didactic instruction in the elucidation of principles. It is my opinion, however, that such didactic instruction, whether it be given by the chair or by the demonstrator, should either precede the actual technic work of the course or be given simultaneously with it.

While I know that the question as to whether the instructor of technics in the exercise of his special province as a teacher should deliver lectures upon the principles underlying any class of practical work is regarded as being unsettled, still it is my opinion, based upon experience, that the student should not be allowed to work in the dark, but that he should have an idea of why he is required to observe certain specified details before he is expected to attempt their execution. Unless he has this advantage he works practically as an automaton, and hence will invariably fail to appreciate the importance of exactness in the execution of minutiæ and detail.

In accordance with such a view, the course in porcelain technology, which I herewith briefly outline, is one which is now being given in the college with which I have the honor to be connected. It will be noted

that an effort has been made to arrange it in a more or less systematic and sequential order, and to have it encompass a range sufficiently broad and practical as to enable the student to become adequately familiar with the details of procedure ***out of the mouth*** to an extent which will at least insure their subsequent more or less successful application in the mouth.

Didactic Instruction.

In connection with the didactic instruction, and irrespective of whether this instruction should come from the chair or from the demonstrator, the course should be inaugurated by lectures upon the fundamentals of the subject arranged and classified as follows:

First—The history and development of the porcelain art.

Second—The composition, characteristics and manipulation of porcelain compounds.

Third—The sources of heat production employed.

First—The first consideration embraces the history and development of this work which may be made materially beneficial to the student as a means of placing his mind in a receptive condition for further enlightenment, as well as to increase his appreciation of the requirements and underlying principles.

Second—The consideration, under the heading of the composition, characteristics and manipulation of porcelain compounds, would embrace:

1. *Composition.*
   The ingredients used.
   Properties imparted by each.
   Method of compounding, etc.
   Tinting, coloring, etc.

2. *Characteristics.*
   Texture.
   Density.
   Strength.
   Fusibility.
   Shrinkage.

3. *Manipulation.*
   Mixing: Trituration, consistency, etc.
   Building: Packing, evaporation of moisture, etc.
   Carving: Occlusion, anatomical outlines, etc.
   Fusing: Tests, shrinkage, vitrification, color, porosity, etc.

Third—This portion of the instruction, which we have designated as "sources of heat production," should include a consideration of the various kinds of furnaces now employed; the manner in which they should

be used and how they may be repaired; and the precautions incident to placing the work in and removing it from the muffle—heating, cooling, etc.

This preliminary didactic course should then be followed by a course in the technic laboratory, which should be sufficiently broad, comprehensive and practical to embrace the application of the fundamental principles as they are thus presented, and which will lead the student up to an appreciation of the various details of procedure involved in, as well as of the precautions incident to, such application.

Technic Instruction. The technic instruction in this work necessarily involves a close interweaving of the departments of operative and prosthetic dentistry, and yet the best interests of the course and of the student will doubtless be conserved by having the teaching all done by one man, or at least under the direct supervision of one particular teacher.

For the purpose of expediting and facilitating the systematic presentation of the work, however, the course should be arranged in three separate divisions: Inlay work, crown and bridge-work and plate-work.

Inlay Work. The presentation of inlay work is purposely made the first part of the course because the greater degree of simplicity which it may be made to involve affords a correspondingly increased opportunity for becoming thoroughly familiar with the fundamental details before attempting the more intricate requirements incident to the construction of more extensive work, and it in turn should then be subdivided into three sections.

Section I. The first section of this part of the course must of necessity be largely didactic and should embrace:

First—The indications and contraindications for the employment of porcelain in the filling of teeth.

Second—The principles and requirements of cavity preparation.

Third—The characteristics and comparative advantages of the metals used for matrices and the adaptation of the matrix.

Section II. Section two should embrace an adequate number of practical requirements, arranged in a more or less sequential order, to enable the student to become thoroughly familiar with the details of procedure incident to an intelligent and successful application.

For such preliminary work the technic outfit designed and supplied by Mr. Robert Brewster will be found so eminently practical and useful as to warrant its recommendation and endorsement. It includes all of the necessary appurtenances and may be most advantageously employed in the following manner:

First—The moulding of a large tooth in porcelain.

Second—The cutting of an approximal and labial cavity in same.

Third—The baking of this tooth.

Fourth—The investment of the tooth with plaster in steel cup, with labial cavity exposed.

Fifth—The adaptation of matrix by swaging directly into the cavity.

Sixth—The filling of the matrix with body and completing the inlay by consecutive bakings.

Seventh—The reinvestment of tooth in perpendicular position in cup, so as to expose approximal cavity and facilitate handling.

Eighth—Adaptation of the matrix by *burnishing.*

Ninth—The filling of the matrix by consecutive bakings.

It will be observed that these various steps are purely fundamental, and yet that they impart a knowledge of, and afford a training in, the preliminary details. While all of the work is done directly on the large porcelain tooth, an idea of the mixing and moulding of the "body," of the formation of cavities, of the fusing and shrinkage of the porcelain, of the necessity for building the filling in layers and by consecutive bakings, and of the adaptation of the matrix *by both methods,* is clearly imparted.

Section III. The third section of this part of the course is intended to be of a more advanced nature and is designed to be done under conditions more closely simulating the natural ones. For this purpose the cavities should be cut in teeth of white vulcanite, bone or some other favorable composition, as a means of imparting a training in the formation of cavities in a material which may be cut and trimmed as required, and with some facility.

Because of the advantage of adjacent teeth to indicate the necessity for separation and to guide in obtaining contour, etc., the Bryant technic models, which should have been made as a part of the preceding work in operative technics, are recommended as probably furnishing the best means available for stimulating these conditions and for admitting an observation of these requirements.

The following consecutive steps should comprise the work in this section:

1. Obtaining adequate separation.
2. Preparation of cavity, involving incisal angle, in anterior tooth.
3. Adaptation of matrix by burnishing.
4. Building, shading and baking inlay.
5. Preparation of cavity, involving approximal and occlusal surface in bicuspid or molar.
6. Taking impression of same in cement or other material.
7. Obtaining die from impression in cement or amalgam.
8. Adaptation of matrix by swaging.
9. Selection of shade or shades and building and baking of inlay.

10. Requirements of mounting and final preparation and mounting of inlays.

It will be noted that these steps are considerably more advanced than those of the preceding section, and also that they may be even further embellished so as to include a larger variety of cavities; the adaptation of either platinum or gold matrices; the use of either high or low fusing bodies, or even to also include the construction of gold inlays, at the option of the teacher and as the time allotted may permit.

Crown and Bridgework. Upon the completion of the above requirements, the work should then become still further advanced, so as to include crown and bridge-work next in order.

This part of the work should also be preceded by didactic instruction, embracing a thorough elucidation of the indications and contraindications in the more extensive application of porcelain to these purposes.

Unfortunately, platinum is the only metal that can be used in conjunction with porcelain when fused, even in technic work; hence this portion cannot well be made to include too many pieces because of the expense involved. Nevertheless, if the course is to materially benefit the student, a sufficient number of pieces to include an application of the more important principles and variations of construction must be required.

Because of the expense involved in the use of platinum, it may sometimes be thought expedient for this purpose to use a very thin gauge. This I regard as a great mistake, for two reasons: *First*, a very thin gauge may be manipulated with so great a degree of facility as not to afford to the student a knowledge of the working properties of the proper gauge for practical purposes; and, *second*, so much depends upon the metal construction of this work that an application of such economical training to practical cases might have a bad influence upon students of such tendencies, for it is well-known that a large proportion even of practitioners often use a much thinner gauge metal for the construction of all kinds of crown work than conserves to the highest degree of strength and permanency in the finished piece. For these reasons the same thickness of metal which would be indicated for practical purposes should invariably be employed.

It is to be regretted that porcelain will not attach, in fusing, to nickel, or some alloy of it, or that the same cannot be so treated by electro-plating or some other means, so as to admit of its use for these purposes, but until such time as this may be possible and the free oxidation of this metal or its alloys under extreme heat may be overcome, the use of platinum is necessary.

The general principles of construction, however, may be taught by requiring a minimum number of pieces, and such would include the construction of:

1. An anterior crown without band, or with partial band.

2. A bicuspid crown with band.

3. A bridge including two abutments and one or more dummies.

This much at least should be finally completed, and should be a positive requirement, as a means of familiarizing the student with those intricate details which differ from gold work and yet which are so essential to the successful application of porcelain work.

Such details as might be thus emphasized, even in this amount of work, would include the following essentials:

1. The requirements of root preparation.

2. The necessity for contact between surfaces to be soldered with pure gold.

3. The requirements in the relation which should exist between facing, or porcelain, and cap.

4. The necessity for securing mechanical retention between porcelain and platinum.

5. The requirements of strength in the metal construction and in the assemblage of several parts.

6. The use of platinum solder and the oxyhydrogen blow-pipe.

7. The necessity of protecting and supporting the porcelain against stress.

8. The building, packing, shading and carving of the body.

9. The influence of and necessary allowance for shrinkage.

10. Precautions incident to the heating, fusing and cooling of the work.

Any desirable variations of metal construction in addition to these may then be required and constructed in German silver, and such pieces as it might for this reason be desirable to incorporate in the course may be used to emphasize all details, excepting that of fusing the porcelain.

Platework. Notwithstanding the lamentable fact that continuous gum dentures are not now often constructed, a course in porcelain technology would not be complete without instruction in this special line.

Because of the expense to the student, however, it would perhaps often work a hardship on him to make the construction of such plates a compulsory requirement. Yet the advantages to be derived from instruction in this phase of the application of porcelain may be obtained by requiring a technic case made on a base of German silver, with continuous gum teeth attached. This will impart all of the detail, except that of baking the body, which may then be covered didactically, and those who can afford and who may prefer to use platinum may do so at their option.

The course thus briefly outlined is presented as representing that

which in my opinion should constitute the *minimum* requirements in porcelain technology; and I recommend that it be regarded as advanced work and hence should not be given until the technic courses in operative and prosthetic dentistry and orthodontia have been completed.

In conclusion, I would say that I regard this subject as a necessary and important addition to or part of the curriculum of all colleges whose faculties appreciate the possibilities of porcelain work, and the importance of thoroughly teaching it, and who recognize its permanency as an art in the practice of modern dentistry.

Discussion.

Dr. J. Q. Byram, Indianapolis. I wish to congratulate Dr. Goslee on this excellent paper. It seems quite fitting that the first paper on Porcelain Technology, before this body, should come from a Chicago teacher, and I know of no better one to present this subject than Dr. Goslee.

The two principal points to keep in mind in teaching porcelain work are, first, how can the student be taught to successfully master this art; and second, how can he be taught to appreciate work of this character so that he will not be injudicious in its application. Dr. Goslee has given an outline for the first, which if followed, will make a very thorough course of instruction.

It is reasonable to presume that certain classes of porcelain work will be indiscriminately and injudiciously employed to as great an extent as bridge-work. So every teacher should guard against this as much as possible by not appearing ultra-enthusiastic in this particular branch. While every phase of this subject should be taught, it should be done in such a manner that the student will be impressed with the necessity of being conservative in the application of porcelain.

A complete course in porcelain technology, not only gives the student a thorough knowledge of porcelain and its application; but assists in developing the artistic and esthetic qualities of his nature. Porcelain technology should be taught in the senior year, but anything tending to

develop the artistic sense of the student should be given in the preceding years; carving teeth from ivory blocks, moulding and modeling in plastic materials and carving cusps to be used as patterns for constructing dies in crown and bridge work and adjuncts to porcelain technology.

I require the students of the college in which I have the honor to teach to carve six teeth from ivory blocks, model sixteen teeth in potter's clay and carve model cusps for all crowns in modeling composition or plaster of paris. This helps them to remember tooth forms so when they begin their porcelain technic they have retained some (at least one or two points) of their dental anatomy.

I agree with Dr. Goslee in that the didactic instruction should precede the technic. The course should be so graded that a technic operation will follow soon after each lecture. It is a mistake to allow the student to perform his technic operations in advance of his didactic instruction, for he never thoroughly appreciates what he is doing.

Our students are given a preliminary course similar to the one outlined by the essayist, section II first, second and third steps, which involves the moulding, the cutting of cavities, and the baking of the large tooth. The essayist says, "Upon the completion of the above requirements (referring to inlay technic) the work should become still further advanced so as to include crown and bridge work next in order." I believe the crown and bridge technic should precede the inlay because the student increases his knowledge and in manipulating porcelains, he also learns to gauge for shrinkage and obtains better results with colors, all of which will assist him in his course in inlay work, which includes the most delicate operations in porcelain technology.

If courses of instruction, both didactic and in technic, similar to that outlined by the essayist are followed, the students of today will graduate with a broader knowledge of porcelain and with greater manipulative skill than those who have preceded them. So I can only commend the outline in its entirety.

I regret that Dr. Goslee did not tell us how he teaches his students to obtain proper shades of colors, for this is the hardest part of the operation in practice. I believe the teachers of porcelain work and of physics should work together, and give the students a more thorough course on light and colors.

In conclusion I wish to thank Dr. Goslee for this excellent paper and to say that we as teachers of dental art should give the subject of porcelain a great deal of consideration and arrange our curriculum so that the students will receive full benefit of a thorough course of instruction on porcelain in all its phases.

Dr. H. L. Banzhaf, Milwaukee, Wis. If the essayist started out with the idea of showing the value of method and system in teaching, aside from suggesting a valuable outline for the teaching of this subject, then in my opinion he has succeeded.

It seems to me that the very first question a teacher should ask himself in teaching porcelain technology is—what is the student prepared for, and second, what, of that which he is prepared for, and which he is to do in technic, does he need next.

That the teacher shall be able to answer these questions, and answer them *correctly*, is imperative, if a fundamental principle in good teaching is to be observed.

The first question relates to the importance of knowing how much didactic instruction upon this specific subject has been absorbed by the student, before technic work shall be undertaken at all. It is hard to imagine how good results *can* obtain, when this instruction does not precede, or at the very least, is carried on simultaneously with technic work.

The second question suggests the importance of aim in teaching. I take it that no one will question this truth, that without a definite purpose in the teacher's mind, there can be no definite assignment of work to be done by the student; and that without this knowing in advance what is to follow, the teacher's work must necessarily be vague and unrelated. No one, of course, will deny that a broad general purpose in the teaching of the entire subject is essential, and conceding this, it still remains true, that the specific purpose must always be to acquire knowledge and skill in a certain clearly outlined direction, in order to accomplish good results without waste of time and energy.

We, as teachers, in teaching any subject, should have our aim sufficiently definite so that it can be stated. If we cannot do that, then there is something wrong, and unless we know our "Course" we ought in all charity to bear with the student who fails in the performance.

We must continually have in mind the things which must be known or done, in order that the purpose may be realized.

The necessity for order in teaching has been forcibly brought out by Dr. Goslee. The general order as laid down by him can scarcely be criticised; but working out the detail must always remain as one of a teacher's prerogatives. Aim and order must be observed, but every teacher has the right to exercise personal freedom or even caprice in teaching. The moment a teacher permits *himself* to be reduced to an automaton, that moment he loses his individuality, and his personal influence over the student, both of which are fatal.

If a teacher knows his subject, has looked at it from every point of

view, has in his preparation thought out the order in which the student is to do this work, then he is the kind of teacher who is able to cope with emergencies as they arise. We know that these conditions do arise, and here it is where the personality of the teacher becomes a vital factor, in fact means success or failure to the student. These are things which can scarcely be described, and must be "to the manner born."

They are facts based on well-established psychological principles, or if you please on common sense.

The propositions as presented to us by the essayist, speak of actual experience, and breathes the breath of life into the principle, from the known to the related unknown. This carried into practice in our laboratories and lecture rooms will usually make of the student an intelligent worker, and surely of the teacher an instructor, and educator.

Dr. J. M. Thompson, Detroit, Mich. When two or more persons agree upon a certain subject there is no room for argument. Dr. Goslee's paper is a masterpiece, and I can only emphasize a few of the points mentioned by him.

Too much cannot be said in favor of teaching the student the names and the relative merits of the materials which are used in the manufacture of porcelain. It does not follow necessarily that the manufacture of different bodies must be taught, but a knowledge of what each ingredient may be expected to produce will lead to a more intelligent selection of materials offered for sale by the different manufacturers.

It matters very little whether inlay or crown and bridge work are taught first. The same general principles govern the manipulation of the porcelain in either line, and as far as the colors are concerned their selection rests entirely with the student. Porcelain may correctly be termed "the spotless one" in dentistry, therefore it calls for the most thoughtful and careful teaching.

Dr. A. E. Webster, Toronto, Can. I never before heard such a good discussion of the subject of teaching, nor better principles than those enunciated by Dr. Goslee. I have here a model that may be used nicely for porcelain inlay work and for crowns. The student can select the shade and shape of the teeth. The teeth are made of vegetable ivory. Dr. Black suggested that we make the rubber harder than we have so that the teeth will stand in position more rigidly. This model is more rigid than we have been making them. The vegetable ivory is easily cut and yet it is quite friable. It cuts much like dentine.

It might be well, for porcelain technic purposes, to experiment with a cheaper material like iron. If bath tubs and porcelain signs can be made

on iron, we ought to be able to make porcelain technics for college purposes in the same way.

Dr. J. N. Sherwood, Buffalo, N. Y. This is an excellent paper. It is well arranged, concise and does not wander from the subject. My first instruction in porcelain technology I obtained from Dr. Goslee, and since then I have endeavored to follow him, working out from my own experience what I could. I would like to ask Dr. Goslee how much of this work, if any of it, should be taught in the freshman year. The work outlined covers such a comprehensive scope that I do not see how all of it can be taught in the course we have now. When we come to the four year course then I can see how the work can be taught to the different classes. Personally, I am not in favor of teaching the work in the freshman year, although I think Mr. Brewster's object in getting up this outfit was that it should be used by the freshmen, but if it is to be taken into the technic course of the junior year, I do not see how we can get the time for teaching all that was outlined in the paper.

I have had some trouble in teaching crown and bridge work to find time in which to do it all, to say nothing of the technic work that belongs to porcelain. I have had to teach the technic work of that in the senior year, which I think is wrong. I have found that after getting in all the work that belongs to ordinary crown and bridge work I have no time left for teaching the technical or practical work in porcelain. There are a few students who will find time to reach that stage because of their ambition and hard work, but they are few in number. As the matter stands today our students graduate with only a limited knowledge of porcelain work. It is not right and something should be done to remedy this evil.

Dr. W. C. Reeves, Chicago. This is the most complete outline of a course in porcelain work ever presented, and it certainly will bring good results. If we cannot agree on the importance of porcelain work, we ought at least to express our opinions on the subject and not be afraid of it. It has come to stay and occupies a more prominent position every year, and speaking of it as "where indicated" should cease. None of you talk about where gold is indicated. It has become a fixed feature in operative dentistry. Consequently it is taught, I might say, indiscriminately. I believe that if porcelain is put on an equal footing with gold as a filling material, it will reap greater benefits for the laity than the employment of gold ever did.

There are a few things in the paper with which I differ. I believe that the student will grasp the technique of crown and bridge work in porcelain more easily than he will inlay work. By that I mean that he will

master the principles of fusing and baking porcelain more easily, and should be well grounded in this. He may get a fill of didactic work in this subject, but he will get his serviceable knowledge only from practical work and observation. He will get it in the baking of porcelain crowns. He gets a better idea of crown and bridge work in a general way than he does of porcelain inlay work.

I do not see that much benefit could be derived from teaching about the different ingredients of porcelain. Why not teach him the same thing about amalgam, or the different methods of producing the various kinds of gold? That feature of the work belongs to the manufacturer. But the student should be taught all about the different kinds of bodies; the results of baking the different bodies; their composition, form and process of manufacture. He should be well versed in the baking of four or five of the bodies before us at the present time.

I think that all of this part of the work should be taught in the junior year, previous to his going to the chair to do any operating. Then he is ready to receive the more advanced instruction in technic and in actual practical work, handling cases, etc.

Dr. Hall, Ann Arbor, Mich. I would like to ask Dr. Goslee how much time should be devoted to the teaching of porcelain. I am sure we are all impressed with the paper and I am convinced that a copy of it would assist us greatly in the formation of our curriculum of the four-year course.

Dr. R. H. Hofheinz, Rochester, N. Y. This is the best paper I ever listened to with regard to the teaching of porcelain work; but what I want to know particularly is this: How would he discriminate, or to whom would he relegate the teaching of porcelain work; the technique and history of it. To the professor of operative dentistry or to the professor of prosthetic dentistry? We discriminate between porcelain inlays and porcelain work on crowns and bridges.

There is one point in the paper with which I do not quite agree, and that is, that it should be taught after orthodontia. I think orthodontia comprises a great deal more than porcelain work; the latter appeals particularly to the technic manual or esthetic side. Orthodontia appeals not only to this but also to the scientific side.

Dr. Goslee. As to which chair shall instruct in the didactic portion of this course, you will remember that the presentation of the course, as outlined, necessitates a close interweaving of operative and prosthetic dentistry. I suggested that the technic instruction might come either from the chair, or from a demonstrator. The didactic work as applied to operative dentistry should

come from the professor of operative dentistry; and that portion which pertains to prosthetic dentistry should come from that chair. These two chairs should then have one instructor to give the technic instruction during the entire course. This is the manner in which the course in our school is conducted. Dr. Johnson delivers all of the lectures pertaining to the indications for porcelain fillings, cavity preparation, etc., and I take care of that portion which covers history, composition, manipulation, crown, bridge and plate work, yet we have but one demonstrator who does all of the technic work.

I said in my paper that I believed that this course should follow the technic courses in operative dentistry, prosthetic dentistry and orthodontia. It is not necessary, however, that it should follow orthodontia, but it should follow the operative and prosthetic courses.

Dr. Thompson. The necessity of having this course follow orthodontia is evident, because if the student has been taught thoroughly in the movements of the teeth and separation first, it will help him greatly in inlay work.

Dr. Hofheinz. The separation of teeth comes under the domain of operative dentistry.

Dr. Sherwood. Dr. Reeves suggested something that has occasioned me considerable trouble. I would like Dr. Goslee to tell us how he manages to teach students the fusing of porcelain. We cannot allow students to handle furnaces indiscriminately, and yet there is no way to acquire that knowledge except by personal experience with the furnace.

Dr. J. E. Nyman, Chicago. In my limited experience as a teacher of porcelain prosthesis I have more trouble teaching the student how to properly manipulate and fuse porcelain body than to do any other part of the work. The training incidental to the construction of gold crowns and bridge work and gold plates is of material assistance to them in the construction of the platinum framework which is the foundation of porcelain crown and bridge work. I have very little difficulty in instructing students to do this part of the work, but in teaching the manipulation of the porcelain body I have a great deal of trouble. It is a substance the manipulation of which is entirely different from the manipulation which obtains in the handling of gold, plaster or amalgam, or any other material, and therefore I would recommend that the courses be so arranged that more work be done in the technique of the manipulation of the porcelain bodies.

In regard to instructing students how to fuse porcelain: I divide my classes into small sections and tell them what my experience has been in the handling of various porcelain bodies; what temperature is necessary

for the fusing; and I also tell them how to handle the various makes of furnaces. I impress upon them, however, that all furnaces vary and that therefore there is a variation in the general instructions I give them. That the same thing is true of the porcelain bodies, that even the same make of body will not always fuse at the same temperature. I teach these sections how to handle the furnace and my instructions always take the side of caution so that they will take more time to fuse the porcelain than is really necessary or than they will allow later on when they have had more practice.

I wish to commend the whole paper very heartily. The subject has been presented in a scientific manner by a man who not only has acquired dexterity himself, but who also has succeeded in imparting this dexterity to others.

Dr. Goslee. Allow me to preface my closing remarks by thanking the society for the manner in which it has received my paper. I also desire to thank those who have discussed it for the kind words said. I should have preferred, however, to have it criticized because it is by criticism that we learn.

In the preparation of this paper—at the suggestion of the chairman of the executive committee—I hardly knew where to begin and where to end, because so far as I know, there has never before been presented anything of similar nature. I had nothing to go by, except my practical experience, and hence, the paper is based entirely upon it.

In his discussion Dr. Byram said that crown and bridge work should precede inlay work in the technic course. Dr. Reeves and Dr. Sherwood were, I believe, also of the same opinion. That is, after all, only a matter of opinion, and I do not know that it is very important in any event. It is my own opinion, however, that inlay work should always precede crown and bridge work because it is more simple in its application. You can learn to manipulate and control a small amount of material quicker than you can a large amount, and you can learn to make the matrix for a cavity quicker than you can learn the requirements of metal construction for crown and bridge work.

We should begin at the bottom, thus taking up inlay work first because of its simplicity, but if you can do better by teaching first crown and bridge work, you ought to begin that way, and yet I believe that my students have profited by beginning with inlay work.

Dr. Byram also said something with reference to teaching students how to obtain the proper colors. You will agree with me in that the color proposition in porcelain work is the hardest thing in connection therewith, and I am sure that Dr. Reeves has found it more difficult of mastery than any other problem in connection with this work. There are, doubt-

less, some students who never can learn to match colors. An eye for color is required, and such an eye is something that not everyone possesses. I believe that we can impart instruction in this by requiring students to put fillings in porcelain teeth in the technic course. For this purpose I have added to this arrangement of the subject the filling of two cavities in porcelain teeth, and as the colors must be matched as closely as possible, it may necessitate the making of several inlays before the desired color is obtained, but this work can, perhaps, best be taught out of the mouth and not in the mouth.

Fusing Porcelain. Next to the problem of color is the problem of fusing. This is one of the most difficult things to teach, but I have not experienced the difficulty mentioned by Dr. Nyman, probably because I go at it differently. He says that all furnaces vary; and that the sources of heat production also vary, which we all know to be true. Hence, it is practically impossible to teach the fusing of porcelain by any *test*. If the sources of heat production, and all of the "bodies" vary, as Dr. Nyman said—and I believe the latter is also true—then it is almost impossible to have any accurate test for the fusing of porcelain.

I am very much interested in this matter because I have pursued different lines in teaching, as well as in practice. I believe that if you will follow this course you can teach anybody to fuse correctly: First of all, learn to do it yourself and then you can teach others, and fuse it by the eye. How do they melt steel? Not by tests. The color of the heat is what they go by. Take the flat surface of a central incisor facing, for instance, and build up a little mound of porcelain on it. Put this into the furnace and watch the fusing until the porcelain has assumed the color of the facing. Porcelain "body," as soon as it is dry, is white, and all you have to do is to watch it more or less closely until the white mass begins to change color, which represents the beginning of vitrification. Then watch it more closely until it is as smooth as the porcelain facing on which it rests. Anyone can learn this, and Dr. Seamons, who is present, will bear me out I think, because it is only recently that I have been able to teach him to fuse porcelain in this way. By beginning with the gold test students may possibly learn quicker because they will not have to observe anything up to the point of the fusion of the gold. Fusing porcelain is altogether a matter of experience, and such knowledge cannot be acquired in the first few days of the course. Watching a furnace heated to such an intense degree of heat, as is required to fuse porcelain, is claimed to be injurious to the eyes, but I have been doing it for years, and have never worn glasses, nor have I had any trouble with my eyes. It is not necessary to get close to the furnace and you need not hesitate to open the door

at any time, because the volume of heat is so great that the immediate ingress of cold air is impossible.

Technic Models.

I referred to the models as being Dr. Bryant's models only because Dr. Bryant manufactures them. Everyone familiar with the transactions of this institute knows that Dr. Webster originally presented the idea before this body in 1899, and I am not giving Dr. Bryant credit for anything except the manufacture of the teeth and models, and for placing them within our reach.

I am very much pleased with Dr. Webster's new model. I know that he has been working on vegetable ivory for some time and hope he has at last found something which will be an improvement on vulcanite teeth, but I have not yet been able to find anything superior to the teeth supplied by Dr. Bryant.

Dr. Webster also suggested that iron might be used in the technic work for porcelain. Iron is less readily oxidized than nickel, but I believe it is equally impossible to fuse the high grade porcelain "bodies" on iron. Nor do I believe that it would be practicable to apply iron to the construction of crown and bridge work. I have not yet found any metal that can be used with the high grades of porcelain, although low grades can be fused on the surface of nickel or iron because their fusing point is not high enough to oxidize the surface of these metals.

As to when this porcelain course should be given: That will depend largely on the teacher and the school. I do not see how I could place it anywhere else than in the junior year, because we want it to follow the technic courses in operative and prosthetic dentistry. It should be given before the senior year and before students have to apply these principles in the mouth, so that I do not see where else in a three-year course it could be given, except in the junior year.

Dr. Reeves said that he did not see the necessity of teaching the composition of porcelain compounds. I do not believe that we could teach the difference between the high and low fusing bodies without teaching their composition. We know that every compound on the market has a proprietary formula, but we do not need to find that out, and should only aim to impart a general knowledge of the composition of the various porcelain compounds, so that students may know the difference between high and low fusing bodies.

Minutes.

The tenth annual meeting of the Institute of Dental Pedagogics convened on December 28th, 29th, and 30th, 1903, at the Iroquois Hotel, Buffalo, N. Y.

December 28th, Morning Session.

Dr. J. D. Patterson, president, called the meeting to order at 11 o'clock Monday morning, December 28th.

On motion of Dr. G. E. Hunt the minutes of the previous meeting, as published in the proceedings, were adopted.

The Executive Board, through the chairman, Dr. W. H. Whitslar, presented the following report which was adopted on motion.

Report of Executive Committee.

The Executive Committee have the honor to present for your consideration the programme of the present meeting.

Beset with the usual difficulties of arranging a programme we were grieved by the death of two members, who had promised papers upon subjects dear to their hearts. Probably no one was more qualified to present certain phases of the dental curriculum than Professor William C. Barrett. It had been his intention to discuss the unification of the curriculi of the colleges of the world. The presentation of facts known to Professor Barrett would have contributed to progressive dental teaching the world over.

By the death of Professor Jonathan Taft, that pioneer of dentistry, we lose the advantage of his knowledge of the historical conditions of the development of the science of dentistry in America, which he could speak of authoritatively.

After the shock caused by these deaths the committee were fortunate in securing two members to prepare papers on short notice. We are under obligations to Doctors George E. Hunt and H. L. Ambler for this courtesy.

The committee have been fortunate in presenting diversified subjects which attract to our meeting those who have not been identified with our institute. We have made an effort to persuade at least twenty schools to become members of the Institute that have not held membership heretofore, and upon this occasion heartily extend an invitation to them to join this organization. All colleges in proper affiliation with the National Association of Dental Faculties are entitled to membership.

The local committee has given the Institute every assistance in preparation of this meeting.

This report would be incomplete if it did not express thanks for the beautifully printed programmes now in your hands which have been donated by the Buffalo Dental Manufacturing Company.

All sessions will be held in this room except the evening session today, which will be held at the dental college. The special order will be papers of Drs. Guilford and Case. Respectfully submitted,

W. H. WHITSLAR, *Chairman.*

The Executive Board recommended the following colleges for membeship: New York Dental School, Colorado College of Dental Surgery, and University of Southern California, College of Dentistry.

Recommendation adopted on motion.

The secretary-treasurer presented his report as follows, which was referred to the Executive Board:

Cash on hand, Dec. 29, 1902	$305.81
Dues for 1903, and back dues	350.00
Bank Interest	6.25
	$662.06
Expenditures as per Ledger	276.79
Cash on hand, Dec. 28, 1903	$385.27

Membership reported, Dec. 29, 1902	35
Colleges admitted to membership at last meeting	1
Colleges defunct	1
Colleges in arrears for two years fees and dropped from membership	2
Present membership, Dec. 28, 1903	33

Immediately after last meeting the report of the committee on curriculum was printed and about 450 copies distributed to all colleges which were members of the National Association of Dental Faculties. Several appreciative notes were received from colleges not members of this body, expressing their thanks. Respectfully submitted,

W. E. WILLMOTT, *Sec'y-Treasurer.*

Dr. G. B. Snow, Buffalo, delivered the following address of welcome to the Institute:

Address of Welcome.

Dr. G. B. Snow. Mr. President, Ladies and Gentlemen: It affords me great pleasure to welcome you on this, your first visit to our beautiful city of Buffalo, as members of the Institute of Dental Pedagogics. I suppose most of those present have been here before, but possibly there are some who have not, and for their benefit I will say that Buffalo is a most beautiful place, especially in the summer. We have near us a lake which carries the commerce of a nation. We also have a dental college of which I am not ashamed. At the Niagara Falls we have the greatest source of power in the world, and there is nothing more strange to me than the way in which this power is developed from this great rushing mass of water, by causing it to turn immense dynomos, mere inert masses of metal until they receive a mighty impulse which they transmute and develop into that subtle force which we call electricity; about which we really know so little. This electricity is conveyed to our city, and turns the wheels of our factories. It furnishes us our light, and when we ride in our street cars, you are drawn by the mighty force of the Niagara river.

In welcoming you, I have only to say that the city is yours. You can do what you will while here, and I hope that when you leave, through contact of mind with mind you may be ennobled and carry home with you new ideas and be able hereafter to do better work. Again I congratulate you, and bid you a most hearty welcome.

Dr. Edward C. Kirk, Philadelphia, responded to the address of welcome as follows:

Dr. Kirk. Mr. President, Professor Snow, and Gentlemen of the Institute: I could have wished you to select some more competent spokesman to voice the sentiment of approval which we all feel in hearing these words of welcome from our hospitable host Dr. Snow. Some years ago I was told by a gentleman, who had a good deal to do with New England audiences, that he found that he did not receive that visible response to his oratory to which he felt entitled, but in analyzing that peculiar frigidity, in New England towns, he said it was one of New England's faults that the natives were not able to express in words the kindly sentiments which they felt in their hearts. So on this occasion I feel as though I were a native of New England, and am not able to express the sentiments of appreciation at the cordial welcome given us by Dr. Snow. I am sure that you will all agree when I say that we have been welcomed by Snow both inside and out,

but this is not to be taken as the measure of the warmth of our reception. So, in behalf of the members of the Institute, I desire to express our extreme appreciation of what he has said and thank him very much for it.

The vice-president, Dr. H. B. Tileston, was called to the chair while the president presented his annual address.

The discussion was participated in by Dr. J. I. Hart (read by Dr. Sanger), Drs. Platt, G. E. Hunt, Guilford, Reeves, Kirk, Cigrand, Hofheinz and Patterson.

The Executive Board recommended that the courtesy of the floor be extended to two visitors from Norway, Drs. Johan Brun and Lorenz Selmer, and to all others connected with Dental Colleges.

Recommendation adopted on motion.

The Executive Board recommended Howard University of Washington, D. C., for membership.

Recommendation adopted on motion.

Adjourned at 12:45 till 2 p. m.

Afternoon Session.

The association was called to order by the president at 2:45 p. m. Minutes of the previous session read and approved.

Dr. G. E. Hunt presented his paper on "The Dental Curriculum."

Discussion was opened by Drs. G. V. Black and J. B. Willmott, and continued by Drs. Long, Friedricks, Platt, Hofheinz, Litch, Gallie, F. B. Noyes, Guilford, Tileston, Shattuck, Bebb, Bethel. Dr. Hunt closed the discussion.

Papers on "How Shall Quizzes be Conducted," were presented by Dr. R. H. Nones, Dr. F. D. Weisse (read by Dr. Starr), and Dr. L. P. Bethel. These were discussed by Drs. Berry, J. B. Willmott, Hoff, Platt, Long, Wilson and Starr.

Adjourned at 6 o'clock.

Evening Session.

Meeting in the lecture room of the Dental College at 8:15 with the president in the chair. Minutes of previous session read and approved. Drs. C. S. Case and S. H. Guilford presented papers on "Orthodontia Technology." Discussion opened by Drs. Webster and Pullen and continued by Drs. Hofheinz, Littig, Hoff, Hillyer, and closed by Drs. Case and Guilford.

Adjourned at 10:45 p. m. till 10 a. m.

December 29th, Morning Session.

Session opened at the college at 10:30, president in the chair. Minutes of previous session read and approved. President appointed Drs. Brophy, J. B. Willmott and Littig a committee on necrology. Executive Board reported as a special order of business for 4 o'clock, a visit to the Buffalo Dental Manufacturing Company's factory. Drs. Cigrand and A. O. Hunt presented papers on "Methods of Teaching the Anatomical Arrangement of Teeth." Discussion opened by Dr. Berry. Adjourned at 12:45 to accept the kind invitation of the authorities of the Dental College to luncheon.

Afternoon Session.

The president called the meeting to order at 2:15 p. m. in the Iroquois Hotel. Discussion of the papers presented at the morning session was continued by Drs. Hoff, Wilson and Bebb and closed by Dr. Cigrand.

Dr. Butler, on behalf of the profession in Buffalo, invited the members to a complimentary banquet to be held in the Iroquois Hotel on Tuesday evening. He also urged the Institute to make a grant towards the funds of the Fourth International Congress at St. Louis.

The president called Dr. Nones to the chair, and presented the following motion, seconded by Dr. Zapffe: "That this meeting authorize the Executive Board to appropriate the sum of $200 to the Congress."

Motion carried.

Dr. D. R. Stubblefield presented his paper on "An Ideal in Pathology." Discussion was opened by Dr. Hertig and continued by Drs. G. E. Hunt, Black and Hartzell, and closed by Dr. Stubblefield.

The Executive Board recommended Tuft's Dental College for membership. Recommendation adopted on motion.

Adjourned at 4 o'clock to accept the invitation of the Buffalo Dental Manufacturing Company to visit their works.

December 30th, Morning Session.

The vice-president called the meeting to order at 10 a. m. Minutes of the previous sessions read and approved.

Paper by Dr. J. D. Moody on "Ethics, Literature and Hygiene—Our New Chair," was read by the secretary. Paper on "The Value of Instruction in Dental History and Literature," was read by Dr. H. L. Ambler. These papers were discussed by Drs. McManus, Cigrand, Kennerley, Thorpe, Black, Hofheinz, Bebb, J. B. Willmott, and closed by Dr. Ambler.

The Committee on Necrology presented the following report which on motion was adopted and ordered to be entered on the minutes:

Report of the Committee on the Death of Dr. W. C. Barrett.

Whereas, This Institute, with deep regret, has learned of the death of Dr. Wm. C. Barrett, a representative in this Institute, from the Dental Department of the University of Buffalo; and

Whereas, In the death of Dr. Barrett this Institution has lost one of its most earnest and devoted members; therefore be it

Resolved, That the Institute of Dental Pedagogics, hereby places on permanent record, the high esteem in which its members hold the memory of the late Dr. Barrett. Especially we emphasize our appreciation of the enthusiasm and marked ability with which he discharged the arduous duties devolving upon him as editor and teacher, the high ideals which he presented, and which he enforced by his personal example; the regularity of his attendance at the local and national meetings of organized dentistry, and the influential part which he took in the proceedings and discussions; and the notable, persistent, and effective effort which he made to redeem the good name of American Dental Association in continental Europe.

Resolved, That a copy of this resolution be forwarded to his widow with an expression of our sympathy with her in her great bereavement.

T. W. Brophy,
J. B. Willmott,
J. Bond Littig, Committee.

Report of the Committee on the Death of Dr. Jonathan Taft.

Whereas, This Institute has learned with deep regret of the death of Dr. Jonathan Taft, a representative in this Institute from the Dental Department of the University of Michigan; and

Whereas, In the death of Dr. Taft the Institute has lost one of its most earnest and respected members; Therefore be it

Resolved, That the Institute of Dental Pedagogies, hereby places on permanent record the high esteem in which its members hold the memory of the late Dr. Taft. Especially we emphasize our appreciation of the valuable pioneer work in our profession, done by him commencing more than sixty years ago, and of which we are still reaping the harvest; of the valuable service which he has rendered as teacher, editor and author; of the uniform good influence which his constant attendance upon, and active participation in the local and national gatherings of organized

dentistry; of the quiet, but widely permeating influence of a long consistent Christian life.

Resolved, That a copy of this resolution be forwarded to his widow with an expression of our sympathy with her in her great bereavement.

T. W. Brophy,
J. B. Willmott,
J. Bond Littig, Committee.

Dr. H. J. Goslee presented a paper on "Porcelain Technology" which was discussed by Drs. Byram, Banzhaf, Thompson, Webster, Sherwood, Reeves, Hall, Hofheinz, Goslee and Nyman. Closed by Dr. Goslee.

Dr. W. G. Foster presented the report of the committee on new appliances, charts and books, and Dr. Hillyer the report of the Master of Exhibits. On motion these reports were adopted and ordered to be entered on the minutes.

Report of Committee on New Appliances, Etc.

Your Committee on New Appliances, Charts and Books, after a careful inspection and consideration of all such as have been presented to this meeting, beg to submit the following report. Your committee has investigated and considered the appliances brought before them in the endeavor that all should receive their due credit. We were instructed to bring to the notice of this body "those things of unusual merit." There are many appliances among the display that, had your committee more time to investigate them, would no doubt have been brought before you. We would suggest that hereafter the Committee on New Appliances, etc., request exhibitors (who desire their appliances specially mentioned before the Institute of Dental Pedagogics) to send this committee type written discriptions of their exhibits in order that the committee may more intelligently study them. Your committee would also suggest that the Committee on New Appliances, Charts, etc., be appointed for a term of two years, or that one member be continued upon it. In this way there would be no break, and the committee would always have the advantage of one member who has served one year and who would be familiar with the committee's work.

Books. A number of books were presented, but we have selected only those that were issued since our last meeting. Dictionary of Medical Science, by R. Dunglisson, 23d edition. Manual of Surgical Treatment, F. F. Burghard, Vol. 6. Text Book of Anatomy by American Authors, F. H. Gerrish, M. D. Text Book of Surgical Principles and Surgical Diseases of the

Face, Mouth and Jaws, by H. H. Grant, A.M., M.D. American Illustrated Medical Dictionary, by W. A. Dorland, A. M., M. D. Dental Materia Medica Therapeutics and Prescription Writing, by E. H. Long, M.D. Manual of Practical Anatomy, by E. J. Cunningham. Success in Dental Practice, by C. N. Johnson, M.A., L.D.S., D.D.S. Essentials of Anatomy, Questions and Answers, by C. B. Nancrede, M.D. American Pocket and Medical Dictionary, by W. A. N. Dorland, A.M., M.D.

Appliances and Charts.

New York College of Dentistry.

A set of thirteen new charts illustrating a syllabus of a course in crown and bridge work. A simplified system of practice soldering showing the blank with backings so arranged as to admit of the investing and soldering.

Pittsburg Dental College.

Dr. Arthur has submitted the Typodont as a model for operative technics and for porcelain technics in making of matrices.

Royal College of Dental Surgeons.

Dr. A. E. Webster presents a systematic method of keeping records of orthodontia done in clinic room. He also presents a table of the chief characteristics of the various bacteria found in the mouth.

Philadelphia Dental College.

Dr. S. H. Guilford presents a large plaster model, with detachable plaster teeth. The socket for each tooth is enlarged at the alveolar border so as to permit of the free movement of the tooth in various directions. Each tooth has inserted in its base an aluminum wire to keep it in position, but which will bend as the tooth is moved. The space between each tooth and its socket is filled with modeling clay, to allow the tooth to yield readily under pressure. This permits each individual tooth to be placed in any desired position of irregularity. Enlarged regulating appliances can be attached to the teeth and operated before the class as they would be in the mouth. Several appliances of this character were shown in connection with the model.

Dr. C. F. Bryant presents his flexible tooth forms for the technic teaching in all forms of dentistry.

Dr. Emory A. Bryant, of Washington, presents his method for the repairing of porcelain facings and bridgework.

University of So. California, Dental Dept.

The Dental Department of University of Southern California presents specimens of comparative dental anatomy.

The first step in the process is to remove the organic matter; this is done by boiling or maceration, the latter method preferable, and is accomplished by keeping the specimens in a stone receptacle filled with water until the flesh has softened so that it can be washed away. Thoroughly dry and remove grease from the specimens by immersion or three days in a gasoline bath. Again thoroughly dry and bleach in commercial peroxide of hydrogen.

W. G. Foster, *Chairman*,
L. S. Tenny.

Report of Master of Exhibits.

Pittsburg Dental College, specimens of student's work upon typodont showing operative methods; also porcelain technic.

University of Michigan, Dental Dept.: Operative and prosthetic methods; views of buildings.

Philadelphia Dental College: Class-room and teaching methods of orthodontia and crown and bridge work.

Vanderbilt University, Dental Dept. Drawings by students showing nine hours' operative technic work.

University of Southern California, Dental Dept.: Specimens used in teaching comparative anatomy.

University of Buffalo, Dental Dept.: Operative, prosthetic and bacteriological exhibits.

Kansas City Dental College: Charts with paper tooth-forms drawn, cut out and mounted by students.

Ohio College of Dental Surgery: Operative technic of first year and second year, prosthetic technic of first, second and third year.

Royal College of Dental Surgery: Students' exhibit in orthodontia.

New York College of Dental Surgery: X-Ray instruction with pictures illustrating same. Physical laboratory charts, student work in anatomical tracings, prosthetic work and charts.

Nineteen late publications were exhibited by Lea Bros. & Co., W. B. Saunders & Co., and J. B. Lippincott Co.

Dr. C. F. Bryant, rubber models, carrying tooth forms for teaching technic work.

Dr. E. A. Bryant, of Washington, D. C., method of repairing bridge work.

The exhibits this year are less in number and, in most instances, less in size than at previous meetings. This can be accounted for in but one way—the fear of repetition of exhibits. As was indicated in the preliminary notices sent out by your master of exhibits, this is a decided mis-

take. New methods and specimens of class work are more than welcome, but there are always present some instructors who have never attended a session of the Institute, and to whom all exhibits are valuable. I would bespeak for my successor in office for the coming year a better response to the call which will be made for exhibits. If new material is not at hand, bring something in order that a full representative exhibit from each college may appear.

Respectfully submitted,

ELLISON HILLYER, D.D.S.

Executive Board reported that the treasurer's book had been audited and found correct.

Moved by J. B. Willmott, seconded by Dr. W. H. Whitslar:

"That the Secretary be directed to convey in suitable terms, to the Dental Department of the University of Buffalo, the Buffalo Dental Manufacturing Co., the Dental Profession in Buffalo, and the Committee on Local Arrangements, our appreciation of the coutesies extended by them to the members of the Institute." Carried unanimously.

The secretary was instructed to thank the management of the hotel, on behalf of the members, for the manner in which the Institute has been treated during the meeting.

On motion of Drs. Hall and Bethel, the Publication Committee was asked to have Dr. Goslee's paper published as early as possible.

Dr. Brun, of Norway, expressed his pleasure at being at the meeting and his appreciation of the courtesies extended to him. A letter was received from Drs. Morgan, Cattell and Dale, expressing their regrets at being unavoidably absent from the meeting.

The next order of business was the election of officers for the ensuing year. In each case the rules were suspended on motion and the secretary directed to cast a ballot for:

President, Dr. H. B. Tileston, Louisville, Ky.

Vice-president, Dr. W. H. Whitslar, Cleveland, Ohio.

Secretary-Treasurer, Dr. W. E. Willmott, Toronto Canada.

Member of Executive Board (three-year term), Dr. L. P. Bethel, Columbus, Ohio.

Invitations were extended to the Institute to hold its next meeting at San Francisco, Los Angeles, New Orleans, Milwaukee and Louisville.

Dr. Goslee introduced the newly elected officers who were duly installed and expressed their appreciation of the honor conferred on them.

The minutes of this session were read and approved and the institute adjourned *sine die* at 1:30 p. m.

W. EARL WILLMOTT, Secy.

The Executive Board accepted the invitation from Louisville and the meeting of 1904 will be held in that city Dec. 28, 29, and 30.

Appendix—A.

List of membership colleges with duly accredited representatives present, dues paid and entitled to vote:

Northwestern University, Dental Department; Dental Department, Vanderbilt University; Louisville College of Dentistry; Royal College of Dental Surgeons; Dental Department, Western Reserve University; Chicago College of Dental Surgery; University of Michigan, College of Dental Surgery: Ohio College of Dental Surgery; University of Iowa College of Dentistry; Indiana Dental College; Kansas City Dental College; University of Buffalo, Dental Department; Dental Department, University of Pennsylvania; Philadelphia Dental College; Department of Dentistry, Detroit College of Medicine; Dental College, Ohio Medical University; Missouri Dental College; Dental Department, University of Omaha: Pittsburg Dental College; New York College of Dentistry; College of Dentistry, University of Illinois; Medico-Chirurgical College, Dental Department; New Orleans College of Dentistry; Cincinnati College of Dental Surgery; Baltimore College of Dental Surgery; Marion Sims Dental College; Milwaukee Medical College, Dental Department; Pennsylvania College of Dental Surgery; New York Dental School; University of California, College of Dentistry; Howard University; Colorado College of Dental Surgery; Tufts College, Dental School; University of California Dental Department.

Membership colleges without accredited delegates:

Southern Dental College; College of Dentistry, University of Minnesota; Keokuk Dental College; Birmingham Dental College.

Colleges represented by delegates, 34; colleges not represented, 4; colleges admitted at this meeting, 5; colleges dropped for nonpayment of dues, 2; colleges defunct, 1; present membership, 38.

Respectfully submitted,

W. EARL WILLMOTT, Secretary and Treasurer.

Appendix—B.

Those in attendance: G. B. Snow, E. H. Long, J. W. Beach, J. L. M. Waugh, D. H. McCoy, H. B. Huver, J. A. Sherwood, C. E. Wettlaufer, J. R. B. Hicks, A. N. Wilbur, R. H. Hofheinz, E. H. Kelsey, A. F. Isham, T. A. Hicks, J. M. Tench, Buffalo, N. Y.; G. S. Shattuck, C. C. Noble, G.

S. Hall, M. T. Watson, Detroit, Mich.; L. P. Bethel, H. V. Cottrell, H. M. Semans, C. A. Hawley, Columbus, Ohio; W. H. Whitslar, H. L. Ambler, G. H. Wilson, D. H. Ziegler, Cleveland, Ohio; L. P. Hall, N. S. Hoff, Ann Arbor, Mich.; G. V. I. Brown, F. H. Berry, J. C. Nyman, Milwaukee, Wis.; G. E. Hunt, Indianapolis, Ind.; J. D. Patterson, Kansas City, Mo.; H. J. Goslee, C. S. Case, T. W. Brophy, C. F. Bryant, W. T. Reeves, G. V. Black, F. B. Noyes, B. J. Cigrand, D. M. Gallie, F. C. Zapffe, Chicago, Ill.; M. C. Marshall, W. F. Lawrenz, J. H. Kennerley, St. Louis, Mo.; F. L. Platt, San Francisco, Cal.; W. Bebb, Los Angeles, Cal.; W. G. Foster, Baltimore, Md.; A. O. Hunt, W. H. Sherraden, H. T. King, F. R. Ross, J. J. McMullen, A. W. Nason, Omaha, Neb.; H. W. Arthur, H. E. Friesell, O. L. Hertig, W. H. Fundenberg, Pittsburg, Pa.; D. R. Stubblefield, Nashville, Tenn.; H. B. Tileston, W. E. Grant, N. T. Jager, Louisville, Ky.; J. B. Willmott, W. E. Willmott, H. Clark, A. E. Webster, W. C. Trotter, E. C. Abbott, H. R. Abbott, Toronto, Ont.; S. H. Guilford, E. C. Kirk, C. R. Turner, Robert H. Nones, W. F. Litch, Philadelphia, Pa.; A. G. Friedrichs, New Orleans, La.; D. E. Sheehan, H. T. Smith, Cincinnati, Ohio; J. Bond Littig, A. R. Starr, Ellison Hillyer, C. M. Ford, W. S. Russell, R. M. Sanger, New York, N. Y.; A. J. Brown, Washington, D. C.; W. I. Chambers, Denver, Colo.; E. W. Branigan, Boston, Mass.

Visitors: C. L. Babcock, Milwaukee, Wis.; F. W. Stiff, Richmond, Va.; B. L. Thorpe, St. Louis, Mo.; Johan Brun, Lorenz Selmer, Christiania, Norway.